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March 1990

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The RAINBOW

THE COLOR COMPUTER MONTHLY MAGAZINE

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Plus: RAINBOWfest Report

03
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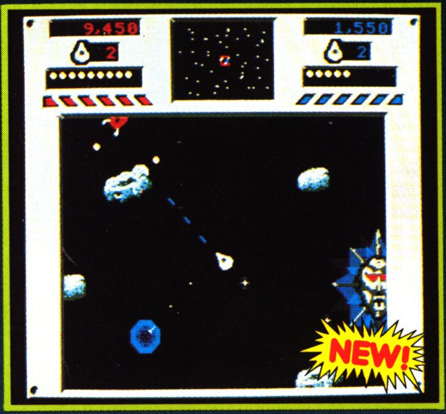
SUNDOG SYSTEMS

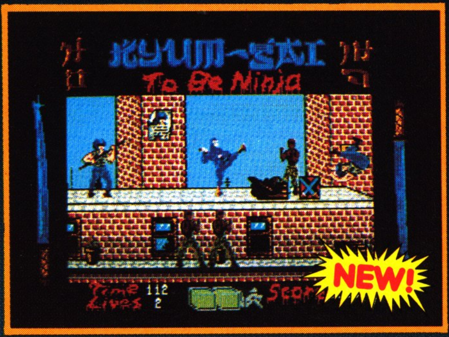
Sinistaar



Sundog Systems proudly presents the first 512K arcade game available for your CoCo III! If you don't have 512K, you will want to get it just for this game! The evil Sinistaars have invaded the galaxy and it falls to you to destroy them. These fiends will attempt to hold you with a constant barrage of drone ships while they muster their strength, and eventually find and obliterate you. Your mission is to mine the myriad asteroids in search of the precious ore which can be refined into sinibombs, your only weapon against the Sinistaars. Many surprises await as you advance through the increasingly difficult stages. Experience the fast-paced action of 512K packed with spectacular graphics, sound effects, and voices! Dozens of stages will keep you coming back for more. Req. 512K CoCo III and disk drive.

$34.95

KYUM-GAI TO BE NINJA



Something is killing off the members of the legendary order of Kyum-Gai. In desperation, its leaders have called upon the powers of the life stone to resurrect you, their greatest hero: the NINJA GAI-DAN. Now, you must find and destroy the evil forces behind this dark plot. Use a multitude of martial arts moves to defeat your enemies, obtain treasure and weapons, and evade obstacles. *Kyum-Gai: to be Ninja* uses the most detailed 320x200 resolution, 16 color graphics, the highest quality digital sound effects, and spectacular animation to bring you the greatest martial arts game your CoCo III has ever seen. Created by the author of *Warrior King*, this incredible arcade game is a definite must for your CoCo III software collection. Join the ranks of the Kyum-Gai and find out what it means to be Ninja! Req. 128K CoCo III, disk drive, and joystick (2-button joystick supported).

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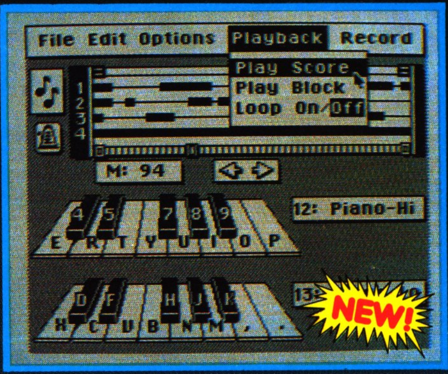
SOUNDTRAX



SoundTrax is an unprecedented sound sequencing system for the CoCo III. It requires *no* extra hardware (i.e. midi keyboards, cables, etc.). All of it is contained in your CoCo. This amazing program will read in a digitized sound and play back all of the notes in the octave in which it was recorded. And it's POLYPHONIC! You can sequence up to four voices at one time, and not only the same sound! With as many voices as can be held in your memory, depending on the song, you can create a score of up to THREE DAYS in length using drums, horns, strings, even your own voice! And you can play them all together! Using the built-in windowing point-and-click editor, you can cut, paste, even synchronize the score to just the way you like it. Use the pre-sampled sounds from the disk included, or make your own by importing them from some of the more popular digitizers available. Also, CALL for the availability of extra sound sample disks! Get it today; you won't believe your ears! Req. 128K CoCo III, mouse/joystick, and disk drive.

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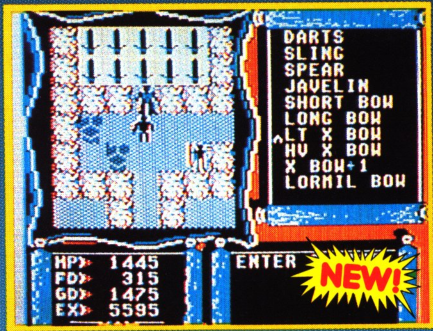
Paladin's Legacy



Years after the mysterious hero called the Paladin disappeared, loathsome creatures, spawned from the bowels of the planet, have overrun the land of Tarinth and captured the king. The situation is grave, for without the king's influence, the three nations will not unite against the growing evil. Only one pure of heart can master the five magics and thereby fulfill the Paladin's legacy and save the realm. Adventure into this vast land of fantasy, interract with its inhabitants, explore the ruinous mines, and do battle with supernatural forces. Experience the magic of the quest in this fast-paced role-playing adventure, all in the familiar quick scrolling, bird's eye play format. You will love the feeling of playing an action game with great graphics, animation, and sound effects, but all the while solving one of the most involved adventures yet. Tarinth awaits its savior! Available for all CoCo models! Req. 64K CoCo and disk drive.

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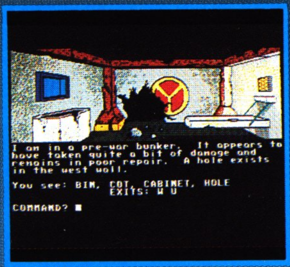

```
I am in a pre-war bunker.  It appears to
have taken quite a bit of damage and
remains in poor repair.  A hole exists
in the west wall.
You see: BIN, COT, CABINET, HOLE
         EXITS: W U
COMMAND? ■
```

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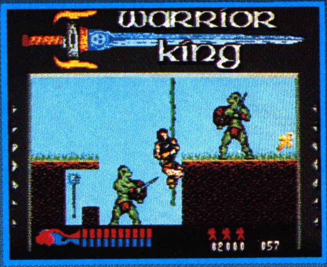

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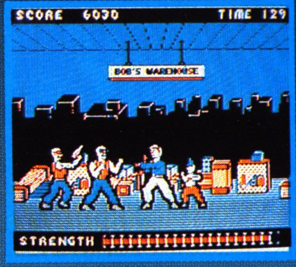

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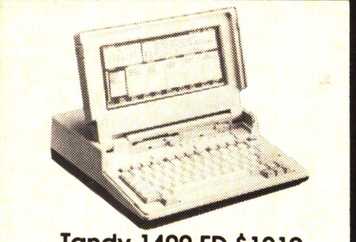

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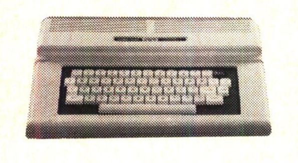

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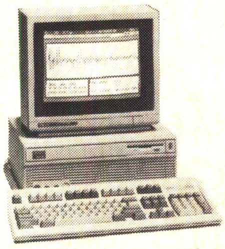

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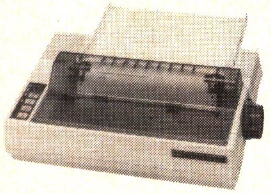

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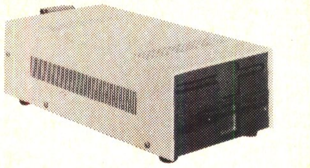

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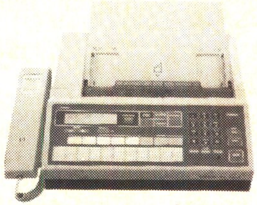

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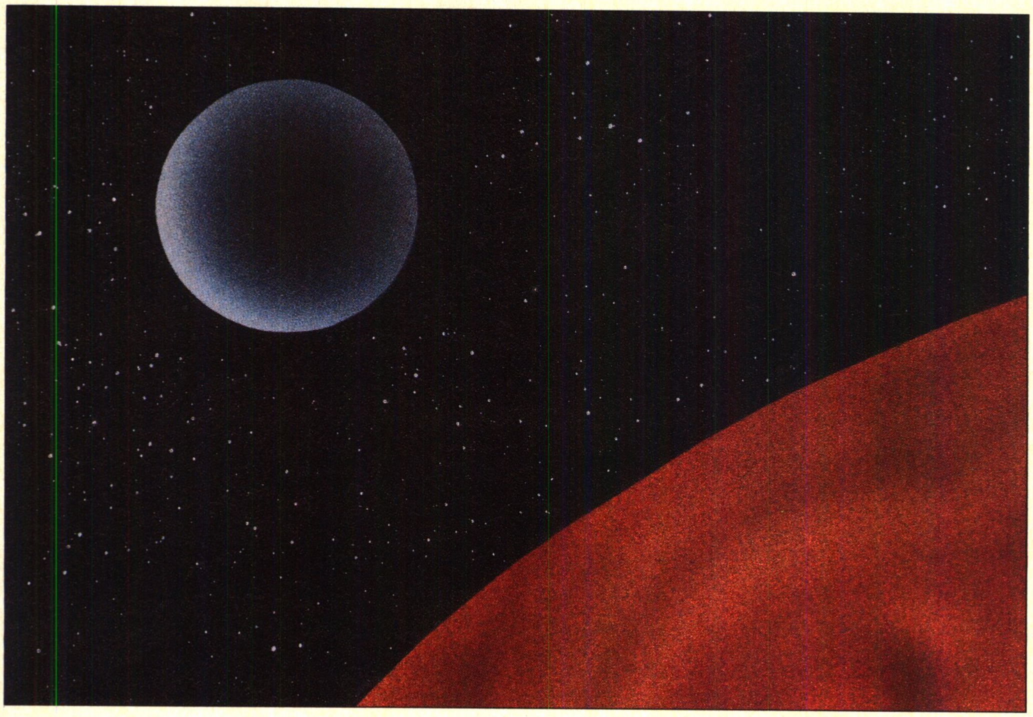

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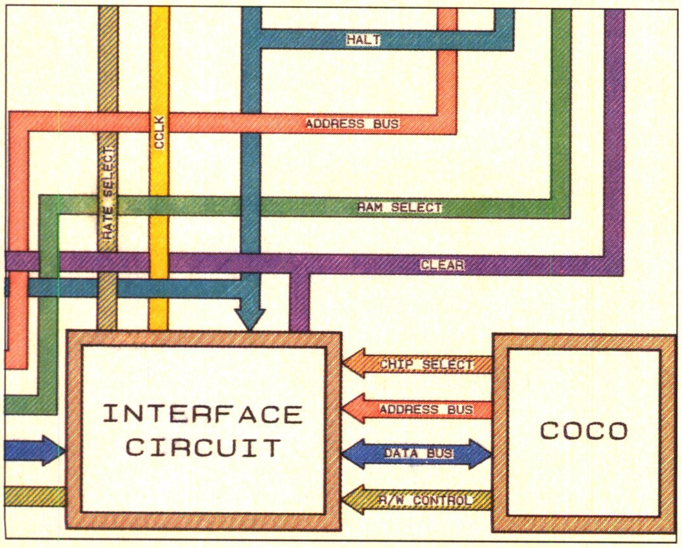

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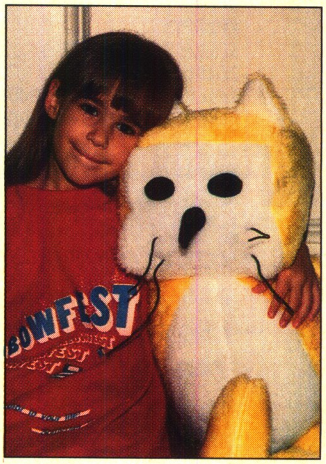

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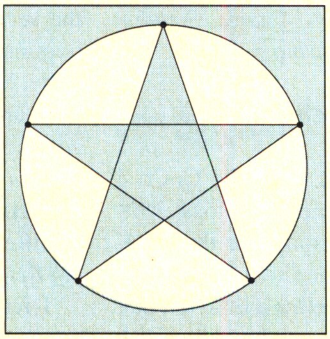

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Letters to the RAINBOW

Editor:

I find the new "BreakPoint" column very interesting and helpful. In Greg Law's last column, he uses a real operating system, OS-9, as well as the C programming language. I also appreciate his inclusion of little known tidbits of knowledge like the use of quotes to modify `cstart`'s interpretation of command line arguments.

I would like to point out two bugs in the listing on Page 89. Line 23 of the published listing reads:

```
if(--argc || chknum(argv[i])) {
```

The corrected line reads:

```
if(!--argc || chknum(argv[1])) {
```

Richard L. Brooks
Phoenix

In Defense of *ScripSit*

Editor:

I am an avid user of *Color ScripSit* and was upset to read that Marty Goodman referred to it in your November issue as "not worth trying to do anything with" to a reader who wrote asking about addressing various fonts on a DMP-106. I suggest that this reader upgrade from that printer to a printer that addresses fonts through its front panel. I get NLQ simply, quickly and easily through my DMP-130A's buttons without going through the software. Some other good advice is to upgrade to *Color ScripSit II*, which allows the use of three separate fonts whose control commands are edited by the user depending on the printer used. Once again, I am not really sure the DMP-106 has any fonts other than standard.

I love this program's unusually powerful abbreviation feature and the ease with which it formats text. The view-as-you-print monitor feature is great, but I especially like *Color ScripSit*'s back-to-basics, no-frills approach.

Charles Scanlon
Simsbury, Connecticut

Feeling Left Out

Editor:

I have noticed that since the CoCo 3 came out, your magazine seems to be drifting toward more programs for the 128K machine and less for the CoCo 2. Those of us with CoCo 2s are feeling a little left out. The same applies for not having a disk drive. One of your regular contributors refused to help me because I did not have a disk drive.

R.T. Jenner
Boscobel, Wisconsin

We are sorry to hear you were refused help. Regarding our mix of CoCo 2 to CoCo 3 material, most of the submissions we are receiving are written for the newer CoCo 3. Yet we still publish as much material for the 16K Extended CoCo as we can.

I Think It's Simply Better

Editor:

I purchased a word processing software package last year after seeing the April '89 article in THE RAINBOW that compares several word processors. It was an excellent article, and I have never been sorry I made the selection I did. I elected to purchase the *Simply Better* word processor package by Simply Better Software. Thus far, I have found no word processing job that this package cannot handle with ease. I love the manner in which *Simply Better* can be configured, and the command set, mostly 2- and 3-key combinations, is logical and easy to manipulate and remember.

The support has been the best part. I have received two upgrades since I purchased the program; the first was free and the second (Version 2.0) was sold for a nominal fee. Any time I have had difficulty, Mr. Rickert has been very willing to help and has done so in a friendly and courteous manner. *VIP Writer*, which I previously used on my CoCo 1 and 2, worked well enough, but I never received the after-sale support that I have with *Simply Better*.

I recommend this package to anyone considering the purchase of word processing software for the CoCo 3. The current version being released, Version 2.0, has even more features that make it difficult to find a comparable program at the same low price.

Michael H. Rambo
Perry, Michigan

Drafting Notice

Editor:

I am looking for a computer-aided drafting program for the Color Computer 3. Is there such a program? If you know of a source for this program, please write me.

Scott A. Baldridge
1559 Jonah Drive
N. Huntingdon, PA 15642

We are unaware of any CoCo 3 software specifically designed for architectural drawings. Perhaps our readers can help.

MIDI Revisited

Editor:

I was pleased to see your article on CoCo MIDI products in the December '89 issue but was disappointed that you completely overlooked one of the first compa-

CIII Pages

by Walter Bayer

The *ultimate* **desktop publishing** program for the CoCo 3. Pull-down menus, icons & dialog boxes, drawing tools (create boxes, polygons, rays, circles, elipses, brush shapes), cut, copy, stamp, paste, zoom, flip, enlarge/reduce, rotate, stretch, undo, import any ASCII text, 2/3 columns & page preview. Includes 14 fonts & 60 pieces of clip art. Req. CoCo 3, RGB/ Monochrome Monitor, Min 1 drive, Tandy Hi-Res Interface, Joystick/mouse & DMP 105/106/Epson/Gemini & Compatible Printer. Only **$49.95**. w / Hires Inteface Only **$59.95.**

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Carl Burtner
Intercomp Sound

We apologize for omitting Intercomp Sound from our MIDI primer (RAINBOW, December 1989, Page 74). We were unaware that Intercomp Sound was still offering products in the CoCo market.

Far and Away

Editor:

I live and work 12 months of the year on a Canadian lighthouse 150 miles from the nearest telephone link. "Delphi Bureau" would be great if I had access to a telephone or a modem. How about putting some of the SIG software on disk? I would love to have a disk full of the tips, patches, hints and short OS-9 programs that appear on the Delphi SIG. I could join the OS-9 Users Group, but a lot of the hints and tips available on Delphi are not available in *MOTD*, published by the OS-9 Users Group.

There must be other CoCo OS-9 users in similar situations. How about helping yourself and others by writing the editor and letting THE RAINBOW and other readers know about your isolation problem?

John A. Coldwell
Prince Rupert, British Columbia

Neglected Characters

Editor:

I've been an OS-9 user since Tandy first made OS-9 Level I available for the Color Computer. Therefore, I appreciate seeing more about OS-9 and more programs for OS-9 in THE RAINBOW. Keep up the good work!

Richard Ries' article "Printing the $#!*& Unprintable" on pages 121 through 123 in the December '89 issue was of interest to me. I recommend one change that users may want to make. In both the BASIC09 and C versions, Mr. Ries has characters with ASCII code greater than the Z replaced with a period. This neglects the characters {, :, } and ~. The braces ({ and }) are used in C programming. I replaced the Z with the tilde (~). Corrections are shown below.

BASIC09 version:

```
IF Ch< " " OR Ch>>"~" THEN
```

C version:

```
if( Ch<' ' || Ch>'~")
```

These changes allow the program `read` to include all printable characters.

William D. Walden
Galena, Ohio

Spread the News on Viruses

Editor:

I really like your magazine and have found a lot of suppliers for software by reading it. This was a big help since my local Radio Shack does not have much CoCo 3 software.

I would like to see more articles on viruses in THE RAINBOW. There has not been much written on this topic up to this point.

Kevin Vivaraies
Lancaster, Ontario

Looking for Bargains Abroad

Editor:

I've had a CoCo 3 and a single disk drive for over a year and have enjoyed both immensely. Now for the first time in my 18-year naval career, I find myself stationed on the West Coast. Seeing as how this state of affairs usually leads to a tour of the Far East and other western Pacific countries, I am wondering if you or any of your readers can tell me where I would be most likely to find some good bargains on CoCo equipment (of course, it's going to go with me).

MMC Dan Statham
USS Sacramento *(ADE-1)*
FPO Seattle, WA 98799-3012

Problem with Graphics

Editor:

I hope I can get help with a problem. I own a CoCo 3 with 128K, an FD-502 disk drive, OS-9 Level II Version 2.00.01 and a CCR-81 tape drive. I cannot use high-level graphics with BASIC09.

The BASIC09 reference section of the OS-9 Level II manual explains, from pages 937 to 939, step-by-step how to use high-level graphics with 128K. Step 1, creating the graphics window, works fine. Step 2, loading BASIC09, takes four to eight times to load (Error 207, Memory Full, occurs until it loads.) Steps 3 and 4, creating and saving the procedure Squeeze, is fine. Step 5, compiling Squeeze, takes five to 10 times before it will work unless you reboot OS-9 and start over (Error 215, Bad Pathname, occurs each time.) After exiting BASIC09 to do steps 6 through 10, I cannot get it to work (Error 207, Memory Full; or Error 237, RAM Full, occurs.) What's going on? Is the manual wrong? Or could it even be a bug?

Robert Brown
2701 Equus Way
Gloucester, Ontario K1T 1W1
Canada

THE RAINBOW welcomes letters to the editor. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for purposes of clarity or to conserve space.

Letters to the editor may also be sent to us through our Delphi CoCo SIG. From the CoCo SIG> prompt, type RAI to take you into the Rainbow Magazine Services area of the SIG. At the RAINBOW> prompt, type LET to reach the LETTERS> prompt and then select Letters for Publication. Be sure to include your complete name and address.

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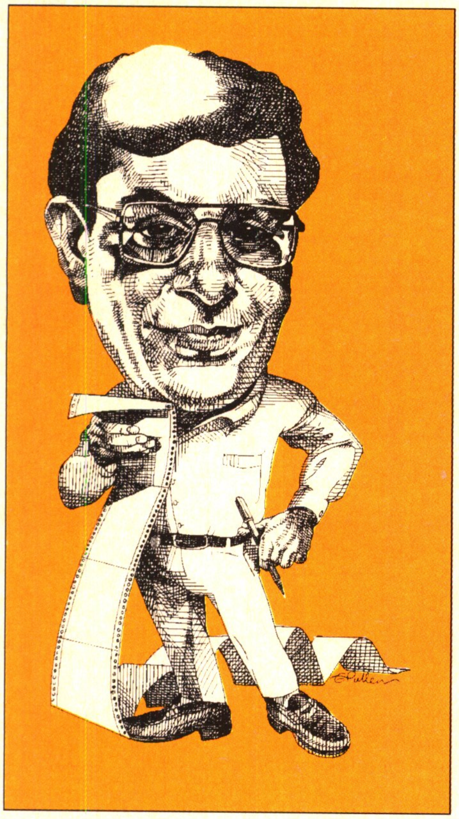

There are some exciting things happening in the Color Computer world as we begin this new decade. Most importantly, the world's longest-lived computer system — our CoCo — seems headed for life well into the 1990s.

While it is no secret that Tandy is scaling down its manufacturing process for the CoCo (which, when you consider 1000 HX prices during the holiday season, means it is putting the price differential between CoCo and MS-DOS that much closer together), there are other portents on the not-too-distant horizon that seem to bode well for the CoCo Community.

Before we get into this, let's look at the two significant issues involved here: price and power.

I have already alluded to price; Tandy and many other computer makers are selling models in the $400-to-$600 range with monitors. Of course that includes a disk drive. Admittedly they are low-level MS-DOS machines in that they do not have blazing speed and power, but they can run most MS-DOS software.

I say *most* because as the high-end MS-DOS machines become bigger and faster, more applications for them will not fit or run effectively in a standard MS-DOS machine. It's something the ads for offshore MS-DOS machines (not Tandy) do not tell you.

But, anyway, perception is important. Yes, the CoCo is still priced low compared to these basic boxes, and this would have a significant effect if it were not for the second part of our equation: power.

One of the finest attributes of the Color Computer has always been that for the basic price you can operate effectively. For the money the processor, processing speed, graphics capability and the like have been far and away above the competition. It was true when a 4K CoCo was $499 and is true today.

Today people want disk drives. People want hard disks. People want super-this and duper-that. While you can do excellent computing on a TV with a CoCo, more and more people are demanding a monitor-type screen. When you start adding these components, the price goes up.

The other saving grace for CoCo has always been, of course, that you can add these components on a pay-as-you-want basis. You can use your TV screen until you really want a monitor. It isn't a big hit in the pocketbook all at once. And, of course — no matter what configuration CoCo you use — the basic design, the 6809, is vastly superior to anything in its class.

Given these two issues, it is no surprise Tandy is emphasizing its MS-DOS line more and more. Whether it will build CoCo for next year's holidays remains uncertain.

However, you *can* expect Tandy support for the CoCo to continue even if it does not build the machine itself. This support, in the form of service, software and some peripherals, will continue to last for years and years. Given this, and because CoCo (1, 2 or 3) is an excellent computer system, owning one is great — unless you thirst for even more power.

Tandy's probable decision not to build more Color Computers in the next several years opens the door for the people who have made many of the most important contributions to the CoCo Community — the third-party developers. In the areas of software and peripherals they have always been significant and will continue to be so. These people, by the way, advertise in THE RAINBOW. You should continue to support them as you have so well in the past.

More significantly, the third-party area is capable of bringing us the long-talked-about Color Computer 4. Whether it will be officially known as such, I do not know (since that would involve some cooperative sharing of trademarks with Tandy), but I am certain the machine or machines to come from third-party sources will be *un*officially known by us as "CoCo 4."

I know of at least two significant groups hard at work right now on a new Color Computer. There may be more. Whatever happens, I think you will probably see prototypes at least during RAINBOWfest Chicago, April 6 through 8. To that end, it may be the most exciting RAINBOWfest since Tandy debuted its CoCo 3 at our show for the first time.

From what the two groups putting these machines together tell me, in the preliminary stages these will be high-powered CoCos at affordable prices. They will most likely be based on the add-on idea that you can start low and expand, but they will have most of the power built in. And from what I hear, either system will be nonexclusive — that is, software that works on one should work on both. And much of the software you have *now* will work as well!

Given some great new innovations in hardware, the wealth of software available (and all the new software that will take advantage of these new machines' capabilities), as well as Tandy's continued support for your present systems, I think the world of CoCo is bright.

—Lonnie Falk

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Right on Time

by Fred B. Scerbo
Contributing Editor

> *If you have an idea for the "Wishing Well," submit it to Fred c/o* THE RAINBOW. *Remember, keep your ideas specific, and don't forget this is* BASIC. *All programs resulting from your wishes are for your use, but remain the property of the author.*

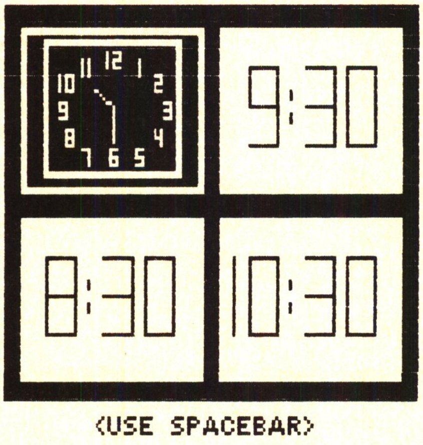
My efforts this month to beat the deadline for submitting "Wishing Well" have ironically given birth to a program I've written called *Watch This*, a clock-reading program. The idea for the program was planted over a year ago after I received a letter from a concerned parent who emphasized that his daughter was having difficulty making the connection between a regular two-hand clock and today's glut of digital wonders.

The Program

Watch This uses the standard shell originally introduced in *Opposite Vol. 1*. I had to make some modifications, though, in order to get the graphics results I wanted.

The task of drawing the clock face with the numbers tends to make a very long string. The string is so long, in fact, that if you were to have each string include the clock face, you would have to clear nearly 9000 bytes just to make room for the strings.

I got around this problem by altering the subroutines to allow two draw statements whenever graphics are required. The actual clock faces are held in `CL$(1)` and `CL$(2)`. Since the digital readout of the time does not require a clock face, `CL$(2)` draws nothing. However, you need to have it in place so that when you reverse the quiz, `CL$(1)` and `CL$(2)` are swapped with each other.



<USE SPACEBAR>

Watch This runs through 48 graphics sets, showing time displayed in 15-minute intervals, starting with 12:00. You will notice that the graphics are stored in 96 separate data statements. They were time-consuming to come up with, but the use of a full-screen editing program allows you to merge lines as needed.

The program lets the user practice reading all 48 time examples and then randomly quizzes him or her on the material.

Using the Program

When the program is run, a menu appears if you press ENTER. Selecting Option A, Review Clocks, allows the user to flip through the examples using only the ENTER key to advance each screen. At the end of the 48 screens, the program restarts.

Both options B and C are the same, except B displays the clock face and C

Fred Scerbo is a special needs instructor for the North Adams Public Schools in North Adams, Massachusetts. He holds a master's in education and has published some of the first software available for the Color Computer through his software firm, Illustrated Memory Banks.

16K Extended

15	251
40	76
65	68
85	5
130	159
160	170
210	137
255	113
300	8
325	102
360	211
400	164
440	100
480	162
515	133
555	78
595	54
635	36
675	239
740	253
780	129
820	16
855	228
895	154
END	40

The Listing: `WATCH`

```
1 REM****************************
2 REM* WATCH THIS:CLOCK SKILLS *
3 REM*   COPYRIGHT (C) 1989    *
4 REM*    BY FRED B. SCERBO    *
5 REM*    60 HARDING AVENUE    *
6 REM*  NORTH ADAMS, MA 01247  *
7 REM****************************
8 CLEAR3000
9 CLS0:PRINTSTRING$(32,220);STRI
NG$(32,204);:FORI=1TO192:READA:P
RINTCHR$(A+128);:NEXT
10 PRINTSTRING$(32,195);STRING$(
32,211);
15 PRINT@390,"    CLOCK SKILLS
  ";
20 PRINT@422,"  BY FRED B.SCERBO
  ";:PRINT@454," COPYRIGHT (C) 1
989 ";
```

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displays the digital readout. Three choices are presented to match with each problem.

A screen appears with four boxes. (Wait a few seconds while it jumbles the problems.) The upper right-hand box displays a choice to be matched with one of the other three boxes. You can advance through the choices by pressing the space bar. Press ENTER when you have arrived at the correct match. The computer tells you if you are right or wrong. If you are wrong, the screen inverts and gives you another try.

You can stop at any time by pressing the @ key, which displays a scorecard. Pressing C to continue lets you pick up where you left off.

As you can tell by now, the shell can accomodate almost any learning material. This means there's plenty of room for your own innovations.

❑

```
25 DATA61,,58,53,56,62,60,61,53,
60,62,61,53,60,61,53,,53,64,78,7
7,76,74,74,,74,77,72,78,76,76,77
30 DATA53,,58,53,,58,,53,52,,58,
52,53,,,53,,53,,72,69,,72,74,,74
,69,,74,,,
35 DATA53,,58,53,,59,51,55,,,58,
,53,,,53,51,55,,,69,,,75,67,74,6
9,,75,67,67,67
40 DATA53,,58,53,,58,,53,,,58,,5
3,,,53,,53,,,69,,,74,,74,69,,,,,
69
45 DATA53,,58,53,,58,,53,,,58,,5
3,,48,53,,53,,,69,,,74,,74,69,,6
4,,,69
50 DATA53,51,59,55,,59,48,55,,49
,59,,53,51,55,53,,53,,64,71,66,6
4,74,64,74,71,66,75,67,67,71
55 X$=INKEY$:IFX$<>CHR$(13)THEN5
5
60 DIM P$(48,3),A$(6),B$(48),C$(
48),A(48),N(48),B(4),C(4),D(4),E
(4),F(4),AO(48)
65 FORI=1TO3:READ C(I),D(I),E(I)
,F(I):NEXT:FORI=1TO6:READA$(I):N
EXT:FORI=1TO48:READP$(I,1),P$(I,
2):NEXT
70 COLOR1,0
75 CL$(2)=”BR1BL1"
80 CL$(1)=”BR20R86D70L86BU70D2R8
4D66L84U66R2ND66BR34BD4ND8BR4R4D
4L4D4R4BD42BL2L4D4R4D4L4U4BH21BL
8R4U8L4D4R4BR62BD4R4U4NL4U4L4BH1
6BD2U8BR10BD8R4D4L4D4R4BD20D8U4L
4U4BL12BD10NR4D4R4D4L4BL30U8L4BL
6BU2L4U4NR4U4R4D8BU28U8L4D8NR4BL
4U8BR14U8BR4D8BF16BD2"
85 CLS:PRINT:PRINTSTRING$(32,”=”
);:PRINT@102,”AN INTRODUCTION TO
“:PRINT@137,”CLOCK SKILLS”:PRINT
@199,”A) REVIEW CLOCKS”:PRINT@26
3,”B) QUIZ CLOCKS”:PRINT@327,”C)
 REVERSE QUIZ”
90 PRINT@388,”<<<SELECT YOUR CHO
ICE>>>”
95 PRINT:PRINTSTRING$(32,”=”);
100 X$=INKEY$:X=RND(-TIMER):IFX$
=”A”THEN355ELSEIFX$=”B”THEN105EL
SEIFX$=”C”THEN895ELSE100
105 CLS0:PMODE0,1:PCLS1
110 LINE(0,0)-(254,170),PRESET,B
115 LINE(6,4)-(122,82),PRESET,BF
120 LINE(128,4)-(248,82),PRESET,
B
125 LINE(6,86)-(122,164),PRESET,
B
130 LINE(128,86)-(248,164),PRESE
T,B
135 DRAW”BM26,188C0NU10R10NU10BR
6R10U6L10U4R10BR6NR10D4NR10D6R10
BR12BU6NE4D2F4BR6R10U6L10U4R10BR
6ND10R10D4NL10BR6NR10D6U10R10D10
BR6NR10U10R10BR6NR10D4NR10D6R10B
R10U10NL4R10D4NL10D6NL14BR6U10R1
0D4NL10D6BR6U10R10D4L10R4F6BR6E4
U2H4"
140 DATA130,6,246,80,6,86,120,16
2,130,86,246,162
145 PAINT(2,2),0,0:PCOPY1TO3
150 PMODE0,4:PCLS1
155 LINE(0,0)-(254,170),PRESET,B
F
160 LINE(8,6)-(120,80),PSET,BF
165 PCOPY4TO2:PMODE0,1:SCREEN1,1
170 DATA”BM2,8C1",”BM130,8C0”,”B
M2,90C0”,”BM130,90C0”,”BM2,48C0”
,”BM130,48C0”
175 FORI=1TO48
180 A(I)=RND(48):IFN(A(I))=1THEN
180
185 N(A(I))=1:NEXTI:FORY=1TO48:C
OLOR1,0
190 FORI=2TO4
195 B(I)=RND(3)+1:IFN(B(I))=0THE
N195
200 N(B(I))=0:NEXTI:FORI=1TO4:N(
I)=1:NEXT
205 B=RND(48):IFB=A((Y))THEN205
210 C=RND(48):IFC=B OR C=A((Y))T
HEN210
215 DRAW A$(1):DRAWCL$(1):DRAWP$
(A(Y),1)
220 DRAW A$(B(2)):DRAWCL$(2):DRA
WP$(B,2):DRAWP$(B,3)
225 DRAW A$(B(3)):DRAWCL$(2):DRA
WP$(C,2):DRAWP$(C,3)
230 DRAW A$(B(4)):DRAWCL$(2):DRA
WP$(A(Y),2):DRAWP$(A(Y),3)
235 COLOR1,0
240 Z=0
245 PMODE0,4
250 DRAW A$(1)+”C0”:DRAWCL$(1):D
RAWP$(A(Y),1)
255 DRAW A$(B(2))+”C1":DRAWCL$(2
):DRAWP$(B,2):DRAWP$(B,3)
260 DRAW A$(B(3))+”C1":DRAWCL$(2
):DRAWP$(C,2):DRAWP$(C,3)
265 DRAW A$(B(4))+”C1":DRAWCL$(2
):DRAWP$(A(Y),2):DRAWP$(A(Y),3)
270 PMODE0,1:SCREEN1,1
275 LINE(8,6)-(120,80),PSET,B
280 X$=INKEY$:IFX$=” “THEN290ELS
EIFX$=”@”THEN905
285 COLOR1,0:LINE(8,6)-(120,80),
PRESET,B:GOTO275
290 Z=Z+1:IFZ=4THENZ=1
295 COLOR1,0:LINE(C(Z),D(Z))-(E(
Z),F(Z)),PSET,B
300 X$=INKEY$:IFX$=” “THEN290ELS
EIFX$=CHR$(13)THEN310ELSEIFX$=”@
“THEN905
305 COLOR1,0:LINE(C(Z),D(Z))-(E(
Z),F(Z)),PRESET,B:GOTO295
310 IFZ+1=B(4)THEN320
315 NW=NW+1:FORK=1TO5:PMODE0,4:S
CREEN1,1:SOUND10,3:PMODE0,1:SCRE
EN1,1:SOUND1,3:NEXTK:GOTO295
320 NC=NC+1:PMODE0,4:PCLS1:LINE(
0,40)-(256,126),PRESET,B:LINE(6,
44)-(124,122),PRESET,B:LINE(130,
44)-(248,122),PRESET,B:PAINT(2,4
2),0,0
325 DRAW A$(5):DRAWCL$(1):DRAWP$
(A(Y),1)
330 DRAW A$(6):DRAWCL$(2):DRAWP$
(A(Y),2):DRAWP$(A(Y),3)
335 SCREEN1,1
340 X$=INKEY$:IFX$<>CHR$(13)THEN
340
345 PMODE0,1
350 PCOPY3TO1:SCREEN1,1:PCOPY2TO
4:NEXTY:GOTO905
355 PMODE0,2:PCLS1:SCREEN1,1:LIN
E(0,40)-(256,126),PRESET,B:LINE(
6,44)-(124,122),PRESET,B:LINE(13
0,44)-(248,122),PRESET,B:PAINT(2
,42),0,0
360 FORI=1TO48:DRAW A$(5):DRAWCL
$(1):DRAWP$(I,1)
365 DRAW A$(6):DRAWCL$(2):DRAWP$
(I,2):DRAWP$(I,3)
370 X$=INKEY$:IFX$<>CHR$(13)THEN
370
375 COLOR1,0:LINE(8,46)-(122,120
),PSET,BF:LINE(132,46)-(246,120)
,PSET,BF:NEXTI
380 RUN
385 DATA”U16"
390 DATA”BR14BD14ND40BR10R20D20L
20D20R20BR6BU12U4BU8U4BU12BR6D40
R20U40NL20BR8D40R20U40NL20”
395 DATA”NR20M+2,-12"
400 DATA”BR18BD14ND40BR10R20D20L
20D20R20BR8BU12U4BU8U4BU12BR10D4
0BR10R20U20L20U20R20”
405 DATA”ND18M+3,-12"
410 DATA”BR14BD14ND40BR10R20D20L
20D20R20BR6BU12U4BU8U4BU12BR6R20
D20NL20D20NL20BR8U40R20D40NL20”
415 DATA”NL20M+5,-12"
420 DATA”BR14BD14ND40BR10R20D20L
20D20R20BR6BU12U4BU8U4BU12BR6D20
R20U20D40BR8R20U20L20U20R20”
425 DATA”NU16M+7,-12"
430 DATA”BR24BD14D40BR10BU12U4BU
8U4BU12BR6D40R20U40NL20BR8D40R20
U40NL20”
435 DATA”NR20M+10,-9"
440 DATA”BR30BD14D40BR10BU12U4BU
8U4BU12BR10D40BR10R20U20L20U20R2
0”
445 DATA”ND16M+10,-9"
450 DATA”BR28BD14D40BR10BU12U4BU
8U4BU12BR6R20D20NL20D20NL20BR8U4
0R20D40NL20”
455 DATA”NL20M+12,-9"
460 DATA”BR28BD14D40BR10BU12U4BU
8U4BU12BR6D20R20U20D40BR8R20U20L
20U20R20”
465 DATA”NU16M+14,-9"
470 DATA”BR20BD14R20D20L20D20R20
BR6BU12U4BU8U4BU12BR6D40R20U40NL
```

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```
20BR8D40R20U40NL20”
475 DATA”NR20M+14,-6"
480 DATA”BR22BD14R20D20L20D20R20
BR8BU12U4BU8U4BU12BR10D40BR10R20
U20L20U20R20”
485 DATA”ND16M+14,-4"
490 DATA”BR22BD14R20D20L20D20R20
BR6BU12U4BU8U4BU12BR6R20D20NL20D
20NL20BR8U40R20D40NL20”
495 DATA”NL20M+14,-3"
500 DATA”BR22BD14R20D20L20D20R20
BR6BU12U4BU8U4BU12BR6D20R20U20D4
0BR8R20U20L20U20R20”
505 DATA”NU16R14"
510 DATA”BR20BD14R20D20NL20D20NL
20BR8BU12U4BU8U4BU12BR6D40R20U40
NL20BR8D40R20U40NL20”
515 DATA”R20”
520 DATA”BR22BD14R20D20NL20D20NL
20BR8BU12U4BU8U4BU12BR10D40BR10R
20U20L20U20R20”
525 DATA”ND16M+16,+2"
530 DATA”BR20BD14R20D20NL20D20NL
20BR8BU12U4BU8U4BU12BR6R20D20NL2
0D20NL20BR8U40R20D40NL20”
535 DATA”NL20M+16,+4"
540 DATA”BR20BD14R20D20NL20D20NL
20BR8BU12U4BU8U4BU12BR6D20R20U20
D40BR8R20U20L20U20R20”
545 DATA”NU16M+14,+7"
550 DATA”BR18BD14D20R20U20D40BR8
BU12U4BU8U4BU12BR6D40R20U40NL20B
R8D40R20U40NL20”
555 DATA”NR20M+14,+9"
560 DATA”BR18BD14D20R20U20D40BR8
BU12U4BU8U4BU12BR10D40BR10R20U20
L20U20R20”
565 DATA”ND16M+11,+10”
570 DATA”BR16BD14D20R20U20D40BR8
BU12U4BU8U4BU12BR10R20D20NL20D20
NL20BR8U40R20D40NL20”
575 DATA”NL20M+11,+12"
580 DATA”BR16BD14D20R20U20D40BR8
BU12U4BU8U4BU12BR10D20R20U20D40B
R8R20U20L20U20R20”
585 DATA”NU16M+10,+14"
590 DATA”BR16BD54R20U20L20U20R20
BD40BR6BU12U4BU8U4BU12BR6D40R20U
40NL20BR8D40R20U40NL20”
595 DATA”NR24M+8,+15"
600 DATA”BR24BD54R20U20L20U20R20
BD40BR6BU12U4BU8U4BU12BR10D40BR1
0R20U20L20U20R20”
605 DATA”ND22M+6,+15"
610 DATA”BR24BD54R20U20L20U20R20
BD40BR6BU12U4BU8U4BU12BR6R20D20N
L20D20NL20BR8U40R20D40NL20”
615 DATA”NL20M+2,+15"
620 DATA”BR16BD54R20U20L20U20R20
BD40BR6BU12U4BU8U4BU12BR6D20R20U
20D40BR8R20U20L20U20R20”
625 DATA”NU16ND16"
630 DATA”BR16BD54R20U20L20ND20U2
0R20BD40BR6BU12U4BU8U4BU12BR6D40
R20U40NL20BR8D40R20U40NL20”
635 DATA”NR20M-3,+16"
640 DATA”BR22BD54R20U20L20ND20U2
0R20BD40BR6BU12U4BU8U4BU12BR10D4
0BR10R20U20L20U20R20”
645 DATA”ND16M-5,+14"
650 DATA”BR18BD54R20U20L20ND20U2
0R20BD40BR6BU12U4BU8U4BU12BR10R2
0D20NL20D20NL20BR8U40R20D40NL20”
655 DATA”NL20M-7,+14"
660 DATA”BR18BD54R20U20L20ND20U2
0R20BD40BR6BU12U4BU8U4BU12BR10D2
0R20U20D40BR8R20U20L20U20R20”
665 DATA”NU16M-9,+14"
670 DATA”BR16BD14ND4R20D40BR6BU1
2U4BU8U4BU12BR6D40R20U40NL20BR8D
40R20U40NL20”
675 DATA”NR22M-10,+13"
680 DATA”BR20BD14ND4R20D40BR6BU1
2U4BU8U4BU12BR10D40BR10R20U20L20
U20R20”
685 DATA”ND18M-10,+11"
690 DATA”BR16BD14ND4R20D40BR6BU1
2U4BU8U4BU12BR10R20D20NL20D20NL2
0BR8U40R20D40NL20”
695 DATA”NL20M-10,+9"
700 DATA”BR16BD14ND4R20D40BR6BU1
2U4BU8U4BU12BR10D20R20U20D40BR8R
20U20L20U20R20”
705 DATA”NU16M-12,+7"
710 DATA”BR16BD54R20U20L20ND20U2
0R20D40BR6BU12U4BU8U4BU12BR6D40R
20U40NL20BR8D40R20U40NL20”
715 DATA”NR20M-12,+5"
720 DATA”BR22BD54R20U20L20ND20U2
0R20D40BR6BU12U4BU8U4BU12BR10D40
BR10R20U20L20U20R20”
725 DATA”ND18M-12,+4"
730 DATA”BR18BD54R20U20L20ND20U2
0R20D40BR6BU12U4BU8U4BU12BR10R20
D20NL20D20NL20BR8U40R20D40NL20”
735 DATA”NL20M-12,+2"
740 DATA”BR18BD54R20U20L20ND20U2
0R20D40BR6BU12U4BU8U4BU12BR10D20
R20U20D40BR8R20U20L20U20R20”
745 DATA”NU16NL14"
750 DATA”BR16BD54R20U20L20U20R20
D40BR6BU12U4BU8U4BU12BR6D40R20U4
0NL20BR8D40R20U40NL20”
755 DATA”NR20NU2ND2M-16,-2"
760 DATA”BR22BD54R20U20L20U20R20
D40BR6BU12U4BU8U4BU12BR10D40BR10
R20U20L20U20R20”
765 DATA”ND16M-16,-4"
770 DATA”BR18BD54R20U20L20U20R20
D40BR6BU12U4BU8U4BU12BR10R20D20N
L20D20NL20BR8U40R20D40NL20”
775 DATA”NL20M-16,-5"
780 DATA”BR18BD54R20U20L20U20R20
D40BR6BU12U4BU8U4BU12BR10D20R20U
20D40BR8R20U20L20U20R20”
785 DATA”NU16M-16,-7"
790 DATA”BR10BD14D40BR10U40R20D4
0NL20BR10BU12U4BU8U4BU12BR6D40R2
0U40NL20BR8D40R20U40NL20”
795 DATA”NR20M-16,-9"
800 DATA”BR16BD14D40BR10U40R20D4
0NL20BR10BU12U4BU8U4BU12BR10D40B
R10R20U20L20U20R20”
805 DATA”ND16M-15,-12"
810 DATA”BR10BD14D40BR10U40R20D4
0NL20BR10BU12U4BU8U4BU12BR10R20D
20NL20D20NL20BR8U40R20D40NL20”
815 DATA”NL20M-11,-10”
820 DATA”BR10BD14D40BR10U40R20D4
0NL20BR10BU12U4BU8U4BU12BR10D20R
20U20D40BR8R20U20L20U20R20”
825 DATA”NU16M-9,-10”
830 DATA”BR16BD14D40BR14NU40BR10
BU12U4BU8U4BU12BR6D40R20U40NL20B
R8D40R20U40NL20”
835 DATA”NR20M-7,-10”
840 DATA”BR22BD14D40BR14NU40BR10
BU12U4BU8U4BU12BR10D40BR10R20U20
L20U20R20”
845 DATA”ND16M-5,-10”
850 DATA”BR20BD14D40BR14NU40BR10
BU12U4BU8U4BU12BR10R20D20NL20D20
NL20BR8U40R20D40NL20”
855 DATA”NL20M-3,-10”
860 DATA”BR20BD14D40BR14NU40BR10
BU12U4BU8U4BU12BR10D20R20U20D40B
R8R20U20L20U20R20”865
IFINKEY$<>CHR$(13)THEN865
870 CLS:SCREEN0,0:LIST730-999
875 DATA BR6BU12U4BU8U4BU12BR6D4
0R20U40NL20BR8D40R20U40NL20”
880 DATA BR10D40BR10R20U20L20U20
R20”
885 DATA R20D20NL20D20NL20BR8U40
R20D40NL20”
890 DATA D20R20U20D40BR8R20U20L2
0U20R20”
895 CLS0:FORI=1TO48:TEM$=P$(I,1)
:P$(I,1)=P$(I,2):P$(I,2)=TEM$:NE
XT:TEM$=CL$(1):CL$(1)=CL$(2):CL$
(2)=TEM$
900 GOTO105
905 CLS:PRINT@101,”YOU TRIED”NC+
NW”TIMES &”:PRINT@165,”ANSWERED”
NC”CORRECTLY”
910 PRINT@229,”WHILE DOING”NW”WR
ONG.”
915 NQ=NC+NW:IF NQ=0THEN NQ=1
920 MS=INT(NC/NQ*100)
925 PRINT@293,”YOUR SCORE IS”MS”
%.”
930 PRINT@357,”ANOTHER TRY (Y/N/
C) ?”;
935 X$=INKEY$:IFX$=”Y”THEN RUN
940 IFX$=”N”THENCLS:END
945 IFX$=”C”THEN270
950 GOTO935
```

Corrections

“Night Strike”(January 1990, Page 65): To prevent a Syntax error in Line 2, add a space between `ORY-3>P` and `THENNEXT`.

“The Base Converter”(January 1990, Page 34): Line 0 was inadvertently replaced with our copyright notice. Line 0 should read `0 DIM N(100)`.

“Play It Again, CoCo”(December 1989, Page 74): The end of the next-to-last paragraph in the middle column on Page 86 should read, “Dr. Hands' conversion program allows *Lyra* files to be converted to CoCo MIDI format.”

“CoCo Gallery”(February 1990, Page 73): The pictures for the first- and second-place winners were inadvertently switched. The image shown for *Reflect* actually belongs with the description for *Lake* and is the second-place winner.

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Worm Invaders From Space

You must protect your city from alien worms

by Eric A. Wolf

A high-resolution action game, *Worm Invaders From Space,* is for the Tandy Color Computer 3. It runs on any system regardless of tape, disk or monitor type. After typing in the program, save a copy or two and start the program by typing `RUN` and pressing ENTER.

Upon starting the game, you see the title screen and the *Worm Invaders'* Hall of Fame scoreboard. In order to start the game, you need to enter the skill level at which you want to play. The skill level you select determines the number of points you receive for each worm hit, the length of the worm's growth after every level, the number of meteors per attack round, and the damage to the city population rating. For now, start at Level 1 by typing the number 1 and pressing ENTER.

The screen clears and the game board is set up. The city you are protecting is at the bottom and you will shoot up at the worm from your lone gun tower at the bottom center of the screen. The current score is in the upper left-hand corner of the screen. Now your survival rating comes up and your defense shields activate on preparation for the worm's advance. The worm advances from the upper left and works its way down, going left to right, top to bottom. Press the space bar to shoot at it. You are allowed only one shot at a time, so timing is crucial. Every time you hit the worm you receive five points if you're playing at the easy level; you receive 10 points at medium level and 15 at difficult level. If you destroy the entire worm before he reaches your shields, you receive bonus points and the game continues with a new and longer worm.

If the worm reaches your shields and devours a portion of it, the aliens start to bombard you with meteors. You can't shoot at these meteors, so you must rely on the remaining strength of your shields to protect you. Most meteors are stopped by the shields, but some may plow through and hit your city, killing people. Every hit on your city decreases your survival rating (which starts at 100 percent). A big meteor hitting your city will, of course, kill more people than the smaller kind.

The game continues until your survival percentage reaches zero. At this time, the game is over and you have the opportunity to enter your name into the scoreboard if you are eligible. You can enter up to 16 characters for your scoreboard name, and upon pressing ENTER you return to the title screen to view the new score table and have the chance to play again.

Eric has been a free-lance programmer for three years. He is 16 years old and attends LaSalle High School. He is the author of several commercial programs including the Newspaper Plus *desktop publishing system. He may be contacted at 1630 N. Johnson St., South Bend, IN 46628. Please enclose an SASE when requesting a reply.*

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Monitor Types

Due to an inconsistancy in the video circuitry of the Color Computer 3, you must tell the program what type of monitor you are using to view the program. You can do this by altering Line 45 to suit your monitor needs. Setting the value to 0 sets it up for an RGB monitor or black-and-white TV, and a value of 1 sets the program to recognize a Composite (CMP) monitor or color television for display. You need to set this variable accordingly and then save the modified program to tape or disk.

Animation Techniques

There is a special graphics procedure I used in the program to put the worm, meteor and laser graphics on the screen for rapid, flicker-free effects. Please feel free to use the routine (found throughout the program) I describe in your own graphics programs. This explanation may appear to be a bit in-depth for the beginner, but it should suffice for the more experienced programmer.

As you probably know, you can display Hi-Res text characters on the graphics screen through the use of BASIC's `HPRINT` command. The way these characters look when drawn is stored in a data table starting at Address $F09D in memory. You can redefine the way these characters look by changing the values in this table. This, along with a slight modification to BASIC, allows you to put the worm/meteor segments, along with the laser fire, on the screen very rapidly and efficiently.

The modification to BASIC is simple. By modifying some of BASIC's ROM code, you can tell BASIC to simply draw the character to the screen and clear whatever is underneath it. Normally, BASIC superimposes (mixes) the character on the screen with the background graphics already under it. BASIC's method will suffice for most things, but it is slow and not needed for this program. Because of this, I told BASIC to ignore that part of its code by writing machine language NOPs (No Operation Codes), coded Decimal 18, over the section of memory where the mixing takes place. This saves the process time of drawing something, erasing it, updating its position, and then drawing it again. With my modification all you do is draw, update and redraw.

Next I redefined the way the exclamation point looks to the way I wanted the segment of my worm to look. I also changed the looks of the quotation mark and number sign (#) to a small circle representing a rock and laser fire segment respectively. In the program, I just set the color I wanted to use (using `PALETTE`) and `HPRINT`ed the characters on the screen. A final note is that if you `HPRINT` a space to the screen, then you clear that block of graphics on the screen. I used it to erase the previous worm tail/meteor position and the laser's previous position on the screen.

At first this may seem a bit complicated. Look over the program, especially at the update missle and worm routines (marked in the listing). Study them and you'll soon understand what all this means. ❑

CoCo 3

55	120
70	135
85	63
95	165
105	243
140	147
165	78
200	118
235	219
255	221
280	48
295	71
320	120
340	106
END	66

The Listing: `WORMINVD`

```
 0 'COPYRIGHT 1989 FALSOFT, INC
10 '*****************************
15 '* WORM INVADERS FROM SPACE *
20 '* Written by: Eric A. Wolf *
25 '* TANDY Color Computer 128 *
30 '*****************************
35 '
40 PCLEAR1:POKE65497,0:WIDTH40:C
LS3:ATTR2,4:CLEAR512:DIM MX(35),
MY(35),MS(35),C(4),P(4),SC(10),S
C$(10):POKE &HF015,18:POKE &HF01
6,18
45 MONITOR=0 ' 0=RGB & 1=CMP/TV
50 IF MONITOR THEN 55 ELSE 60
55 CMP:PALETTE0,0:PALETTE1,16:PA
LETTE2,32:PALETTE3,63:PALETTE4,3
2:PALETTE5,7:PALETTE6,36:PALETTE
7,18:PALETTE8,21:PALETTE9,30:PAL
ETTE12,18:PALETTE13,36:PALETTE14
,16:PALETTE15,0:C(0)=36:C(1)=5:C
(2)=7:C(3)=7:C(4)=36:GOTO65
60 RGB:PALETTE0,0:PALETTE1,7:PAL
ETTE2,56:PALETTE3,63:PALETTE4,56
:PALETTE5,36:PALETTE6,54:PALETTE
7,18:PALETTE8,34:PALETTE9,10:PAL
ETTE12,18:PALETTE13,54:PALETTE14
,7:PALETTE15,0:C(0)=54:C(1)=4:C(
2)=32:C(3)=36:C(4)=54
65 CLS3:FORY=1TO10:SC$(Y)=STRING
$(16,127):SC(Y)=0:NEXTY
70 CLS:ATTR3,4:PRINTTAB(4);"<< W
orm Invaders From Space >>":ATTR
6,4:PRINTTAB(8);"Written by Eric
 A. Wolf":ATTR2,4:PRINTTAB(3);"F
or a TANDY 128k Color Computer 3
"
75 LOCATE6,6:ATTR5,4:PRINT"Worm
Invaders' Hall of Fame":ATTR4,4:
FORY=1TO10:S$=STR$(Y):LOCATE 7-L
EN(S$),Y+8:PRINTS$;") ";SC$(Y);:
S$=STR$(SC(Y)):S$=RIGHT$(S$,LEN(
S$)-1):S$=STRING$(6-LEN(S$),"0")
+S$:PRINT"  ";S$:NEXTY
80 LOCATE0,22:ATTR3,4:INPUT"SKIL
L LEVEL (1-EASY 2-MEDIUM 3-HARD)
";SK:IF SK<1 OR SK>3 THEN 80
85 IF SK=1 THEN S1=.8:S2=1:R1=2.
5:R2=.7 ELSE IF SK=2 THEN S1=.9:
S2=1:R1=2.6:R2=.8 ELSE IF SK=3 T
HEN S1=1.1:S2=1:R1=2.7:R2=.9
90 C=&HF09D:FORY=8 TO 15:POKE C+
Y,254:NEXTY:POKE C+8,124:POKE C+
15,124:FORY=24 TO 30:POKE Y+C,24
:NEXTY:POKE C+31,0:FORY=16 TO 23
:POKE C+Y,62:NEXTY:POKE C+16,0:P
OKE C+17,28:POKE C+21,28:POKE C+
22,0:POKE C+23,0
95 HCOLOR1,0:HSCREEN2:C1$="S2;R2
0D20R10U10R10U30R20U20R16D36R10D
8R10D8R30U20R4U10R4U12R12D12R8U1
2R12D12R4D20R16U40R20D30R10U24R1
2D20R10D10R20D12F4R12U40R10U10R2
0D12R4D12R16":HDRAW"BM0,188;C1;"
+C1$:HDRAW C1$:HPAINT(0,191),1,1
:HPAINT(160,191),1,1
100 C2$="R8U20E4U20E2R12F2D4F2D1
6F4R8U4R16D16R8U12R20U38R20D22F4
R16F4D16R16U8R8R16U8R12D8R12U16R
16D24R8E2U8EU16R20D40R12U20E4U20
E2R16F2D16F4R20F8R16":HDRAW"BM0,
188;C2;"+C2$:HDRAW C2$:HPAINT(0,
191),2,2
105 'HLINE(160,156)-(168,192),PR
ESET,BF:HDRAW"S4;BM161,192;C9;BR
6U12H3G3D12E2R2F2":HPAINT(164,18
4)
110 HCOLOR3:HPRINT(0,0),"SCORE:
000000":PLAY"T255L255;V31;05;"
115 SC=0:LV=1:SV=100:MI=1:WM=7+S
K:ST=0
120 REM ** SETUP FOR LEVEL
125 WL=WM:WP=40-WL+ST*40:A$="CUR
RENT SURVIVAL RATE "
130 IF INT(SV)<=0 THEN 310
135 S$=RIGHT$(STR$(INT(SV)),LEN(
STR$(INT(SV)))-1):A$=A$+S$+"%":H
COLOR5:HPRINT(20-(LEN(A$)/2),10)
,A$
140 PLAY"T255L255;V31;02;":IF LV
<>1 THEN FORY=1 TO SV:SC=SC+1:GO
SUB285:PLAY"CC":NEXTY
145 HLINE(160,156)-(168,192),PRE
SET,BF:HDRAW"S4;BM161,192;C9;BR6
;M-2,-10;E2H3G3F2M-2,+10;E2R2F2"
:HPAINT(164,186),9,9
150 HCOLOR2:HPRINT(11,5),"DEFENS
E SHIELDS UP"
155 ST=ST+1:IF ST>4+SK THEN ST=0
160 HCOLOR3:FORX=0TO146 STEP 6:F
ORY=113 TO 145 STEP 8:HLINE(X,Y)
-(X+4,Y+6),PSET,BF:HLINE(315-X,Y
)-(315-X+4,Y+6),PSET,BF:NEXTY,X
165 A$=STRING$(38,32):HPRINT(1,1
0),A$:HPRINT(1,5),A$
```

```
170 REM ** MAIN GAME LOOP **
175 GOSUB280 'Update Worm
180 GOSUB290 'Check spacebar
185 GOSUB295 'Update user's miss
ile
190 WP=WP+1:IFWP+WL=760 THEN225
195 IF WL THEN 175 ELSE IF WP+WL
>559 THEN 225 ELSE HCOLOR2:HPRIN
T(11,6),"DEFENSE TOO STRONG":HPR
INT(11,7),"FOR METEOR ATTACK":HC
OLOR3:HPRINT(13,9),"BONUS 2000 P
TS":PLAY"O3":FORY=1 TO 40:SC=SC+
50:GOSUB285:PLAY"CC":NEXTY:LV=LV
+1
200 PLAY"O5":TIMER=0
205 IF TIMER<300 THEN 205
210 WM=WM+S2:IF WM>20 THEN WM=20
215 A$=STRING$(30,32):HPRINT(5,6
),A$:HPRINT(5,7),A$:HPRINT(5,9),
A$:GOTO125
220 REM ** METEOR SHOWER **
225 FORZ=WP TO WP+WL:HPRINT(Z-(I
NT(Z/40)*40),INT(Z/40))," ":NEXT
Z:HCOLOR6:HPRINT(10,6),"-- METEO
R ATTACK --":PLAY"V31L255T255":F
ORZ=1TO15:PLAY"12;11;9;7;5;2;V-;
V-":NEXTZ:MT=RND(15)+(5*SK)
230 FORY=1TO MT:MX(Y)=RND(40)-1:
MY(Y)=-Y*2:MS(Y)=RND(2):NEXTY:T=
MT:A$=STRING$(40,32):HPRINT(0,6)
,A$
235 HCOLOR8:FORZ=1TO MT:FL=0:EXE
C43345:MY(Z)=MY(Z)+1:IFMY(Z)<2 O
RMY(Z)>99 THEN265 ELSE IFMY(Z)>2
3 THENT=T-1:HPRINT(MX(Z),MY(Z)),
" ":MY(Z)=99:GOTO265
240 HPRINT(MX(Z),MY(Z)-1)," ":A=
HPOINT(MX(Z)*8+4,MY(Z)*8+5):IF((
A=1 ORA=2) AND MY(Z)>22 AND MS(Z
)=2) OR ((A=1 ORA=2 ORA=3) AND M
S(Z)=1) THENFL=1
245 HPRINT(MX(Z),MY(Z)),CHR$(35-
MS(Z)):IFMS(Z)=2 ANDA=3 THENMS(Z
)=1
250 'IF A=3 THEN 260
255 IFA=3 THEN260 ELSE IFFL=0 TH
EN265 ELSE IFMS(Z)=2 THENSV=SV-R
1 ELSE IFMS(Z)=1 THENSV=SV-R2
260 IF FL THEN GOSUB275:HPRINT(M
X(Z),MY(Z))," ":MY(Z)=99:HCOLOR8
:T=T-1
265 NEXTZ:IFT<>0 THEN235
270 LV=LV+1:GOTO 210
275 IF A=3 THEN RETURN ELSE FORQ
=0TO4:P(Q)=PEEK(&HFFB0+Q):PALETT
E Q,C(Q):NEXTQ:PLAY"O1;V31;AAFF"
:FORQ=0TO4:POKE &HFFB0+Q,P(Q):NE
XTQ:RETURN
280 HCOLOR7:Z=WP:HPRINT(Z-(INT(Z
/40)*40),INT(Z/40))," ":Z=WP+WL:
HPRINT(Z-(INT(Z/40)*40),INT(Z/40
)),"!":RETURN
285 HCOLOR3:SC$=RIGHT$(STR$(SC),
LEN(STR$(SC))-1):HPRINT(13-LEN(S
C$),0),SC$:RETURN
290 IF PEEK(345)<>247 THEN RETUR
N ELSE IF MI=0 THEN RETURN ELSE
PLAY"O1;EEEE;V27;DDD;V23;CC;V20;
BB;V16;A;V31;":MY=20:MI=0:RETURN
295 IF MI THEN RETURN ELSE HCOLO
R6:HPRINT(20,MY),"#":HPRINT(20,M
Y+1)," ":MY=MY-1:IF MY<1 THENMI=
1:HPRINT(20,MY+1)," ":RETURN ELS
E IF HPOINT(160,MY*8+4)<>7 THEN
RETURN ELSE WL=WL-1:WP=WP-1:HPRI
NT(20,MY+1)," "
300 HCOLOR5:HPRINT(20,MY),"!":PL
AY"T255L255;O4;CCAA":HPRINT(20,M
Y)," ":MI=1:SC=SC+(SK*5):GOSUB28
5:RETURN
305 REM ** "END".. NO SURVIVORS!
310 HCOLOR5:HPRINT(15,8),"GAME
OVER":HCOLOR6:PLAY"V31;O3;T255L2
55;":FORY=1TO15:PLAY";12;11;10;9
;8;7;6;5;4;3;2;1;V-;V-":NEXTY:HP
RINT(8,10),"SURVIVING POPULATION
 = 0":TIMER=0
315 IF TIMER<360 THEN 315
320 HSCREEN0:CLS:PL=0:FORP=1TO10
:IF SC>SC(P) THEN PL=P ELSE NEXT
P
325 IF PL=0 THEN 70 ELSE CLS:ATT
R2,4:LOCATE4,7:PRINT"You've ache
ived a Great Score!!":LOCATE0,10
330 ATTR3,4:PRINTTAB(5);"Now ent
er your name for all":PRINTTAB(5
)"to see on the Worm Invaders'":
PRINTTAB(5)"Hall of Fame Scorebo
ard"
335 ATTR3,4:LOCATE0,14:PRINTSTRI
NG$(40,32):LOCATE11,14:PRINTSTRI
NG$(16,127):LOCATE10,16:PRINT"(1
6 Letter Maximum)"
340 ATTR2,4:LOCATE11,14:LINEINPU
T N$:IF LEN(N$)>16 THEN SOUND1,1
0:GOTO335 ELSE N$=N$+STRING$(16-
LEN(N$)," ")
345 IF P=10 THEN 350 ELSE FORX=1
0 TO P+1 STEP-1:SC(X)=SC(X-1):SC
$(X)=SC$(X-1):NEXTX
350 SC$(P)=N$:SC(P)=SC:GOTO70
```

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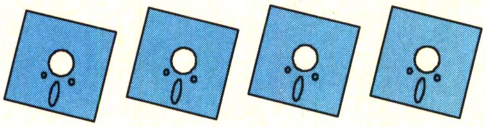
Disk Drives and the Color Computer



by Martin H. Goodman

One of the most common questions I receive in the mail and on Delphi concerns how to add a given floppy disk drive to a Color Computer and whether a given drive can be used at all. RAINBOW Magazine and I decided that a compendium of information would be of interest to you.

A disk drive system for a Color Computer typically consists of a disk controller card, one or more floppy disk drives with associated cases and power supplies, and a cable that hooks the physical disk drives to the controller. When buying a disk system for a Color Computer, you often buy all of these at one time. However, hardware tinkerers are known to buy only the disk controller card and then supply the physical disk drives, cables and power supplies themselves.

The Disk Controller Card

The disk controller card usually plugs into either the Color Computer's expansion slot (game cartridge port) or into Slot 4 of the Radio Shack Multi-Pak Interface. Almost all floppy disk drive controller cards for the Color Computer, by Radio Shack or third-party vendors, are electronically the same. They differ mainly in the number of options featured or supported. For example, the Radio Shack disk controller card is just a disk controller card, whereas other brands may offer the option of adding within the card a serial or parallel port, real-time clock, or a hard drive host adapter.

No-Halt Controllers

A few of the designs are special in that, under OS-9, they have circuitry that supports *no-halt* operation. That is, unlike most controllers, the 6809 is not shut down during disk reads and writes. Currently only CRC offers such a controller: the Super Controller II. Such no-halt operation is also available with some deluxe hard disk drive packages such as those offered by Frank Hogg Labs and Owlware. These systems support high-density 1.2- and 1.44-Meg disk drives not supported by any other CoCo controllers. Remember, though, Super Controllers operate in No-Halt mode only under OS-9, and the other two systems either don't operate at all under Radio Shack DOS or may present significant compatibility problems when they do. The combined hard drive/no halt floppy systems are also relatively expensive. Ordinary Radio Shack Disk BASIC users are not likely to be interested in them, while sophisticated OS-9 users may find such systems extremely desirable.

Repairing a Disk Controller

Radio Shack-style disk controllers fail occasionally. The most common source of failure is a burned-out 7406 or 7416 chip, of which there are usually two. The chip that services the NMI and Halt lines is the most likely one to blow. Often just removing, socketing and replacing the chip will fix the controller. I have occasionally repaired controllers blown by some other small-scale logic chip associated with the NMI or Halt line circuitry, causing the NMI and/or Halt line to be locked on. While the main controller chip(s) occasionally fail, this is less common. Replacement Western Digital 1773 controller chips are available from CRC/Disto.

Disks and Disk Drives

A number of characteristics distinguish floppy disk drives from one another. The drive's disk size is one important characteristic. Floppy disks come in media diameters of 8, 5¼, 3½, 3¼, 3, 2.8 and 2 inches. Most Color Computer users use only the 5¼- and 3½-inch disks and associated drives.

The original 5¼-inch disk drives had a mechanism and face plate roughly 3¼ inches

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wide. This was dubbed *full-height*. It has been years since such drives were made, but many Color Computer users still use them. For the last several years, virtually all new 5¼-inch drives made are half that width and called *half-height* drives. These are supplied by Tandy for its FD-502 system and by most third-party Color Computer suppliers. As a warning, however, we have had many reports of problems from people using Qume brand half-height 5¼-inch floppies. Especially good are TEAC, TEC, Toshiba, Shugart, Panasonic and Matsushita brands, and I have heard good things about Fujitsu and Tandon.

Some manufacturers made 5¼-inch drives one-third the width of the original full-height drive, for use in early lap portable and luggable computers. Epson and OKI were among these. Shugart made a 5¼-inch drive two-thirds the width of a full-height drive. I don't recommend these SA200-type Shugart drives. The first 3½-inch drives were made a width equivalent to half-height 5¼-inch drives. Later, many were made to widths roughly a third of the original 5¼-inch drives to facilitate their placement in lap portables.

The original 5¼-inch disk drives supplied by Tandy with the Color Computer have a single read/write head so you can write on only one side of the disk. These drives are 5¼-inch, 48-track-per-inch, 35-track drives that store a total of 157.5K of data after they have been formatted. Radio Shack's Disk Extended Color BASIC is written only for such drives. Soon after this CoCo standard was carved into the silicon of the Disk BASIC ROM, the rest of the world of computer users standardized around 40-track (180K) single-sided disk drives, then rapidly switched over to 40-track double-sided (360K) 5¼-inch drives. Double-sided drives (all currently made floppy drives are double-sided) have two read/write heads and use both sides of the disk. Thus, Radio Shack Disk Extended BASIC is obsolete in its capability to access modern disk drives.

The first TEC brand full-height drives supplied by Radio Shack in a gray case could access only 35 tracks, and they were unreliable due to the cam-based head positioning mechanism. These were later replaced in Radio Shack's line with Tandon brand full-height drives supplied in a white case. The Tandon drives were of excellent quality and actually capable of accessing 40 tracks if accessed using properly modified software (such as OS-9 or *ADOS 3*). Tandy then switched to half-height drives. The FD-500 and FD-501 systems used good quality single-sided, half-height drives. The FD-502 system being sold by Tandy for the Color Computer has double-sided 40-track drives. Even if you have an FD-502 system or other double-sided 40-track drive(s), you can still access only one side and only 35 tracks under unmodified Disk Extended Color BASIC.

Other DOSs

It is trivial to accommodate OS-9 to newer disk drive types. However, to properly use RS-DOS with newer drives and retain respectable compatibility, you must burn a new ROM with a modified DOS. There are a number of products available that accomplish this. I recommend Spectrosystem's *ADOS*, *ADOS 3* and *Extended ADOS 3* as the most reliable and compatible of all RS-DOS enhancements. Those looking to buy hard drives, however, should examine the RS-DOS enhancements by RGB systems, Owlware, and Burke and Burke.

Many companies also made 5¼-inch full- and half-height disk drives capable of writing 80 tracks per side. This 80-track (96 tracks per inch) drive could support 720K of data per double-sided disk. They tend to require high-quality disks. This disk drive was used in many CP/M computers and the

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DELUXE ICON EDITOR

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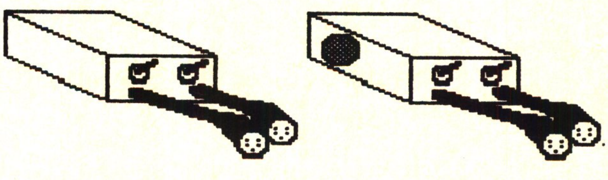

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Tandy 2000. They never really caught on in most IBM PC-compatible computers. In years past, this drive became popular with a minority of OS-9 CoCo users. The drive was less popular with Disk Extended Color BASIC users but supported by *ADOS 3* and *Extended ADOS 3*. In fact, *Extended ADOS 3* even provides good software support for mixing one 80-track and one 40-track drive in the same system. More recently, users of such 720K 5¼-inch drives tend to switch over to the far more common 720K 3½-inch drives.

Bigger Drives

With the introduction of the IBM PC AT, a new kind of 5¼-inch drive was developed. This drive, which actually was more closely related electronically to older eight-inch drives than it was to other 5¼-inch drives, used a different type of floppy disk media and could support twice the density of data per track, as well as twice the speed of data transfer. These drives were arranged so they could write 1.2 megabytes per disk. However, an electronically different type of controller was needed to talk to them, and they had to use completely different disks with a much greater magnetic coercivity of their media. In fact, a disk designed to work in a 5¼-inch 1.2-Meg drive will not work in a 40-track 360K 5¼-inch drive, nor will it work in an 80-track 720K 5¼-inch drive because of the difference in required media. As noted above, none of the ordinary Color Computer controllers can talk to this kind of drive. Using more esoteric controllers, you can make this drive work with a Color Computer and can even (with proper software) get it to read both 360K and 720K 5¼-inch disks. But you cannot reliably write to a 5¼-inch disk that was formatted on a 360K or 720K drive due to difference in track size, media type or both.

There currently exist in the IBM world two standard 3½-inch drives. Both are 80-track (144 tracks per inch). One is electronically identical to the 720K 80-track 5¼-inch drive and supports 720K of data per disk. This 3½-inch drive is becoming increasingly popular with Color Computer users. The other 3½-inch drive supports 80 tracks with 1.44 megabytes of data per disk. This drive requires the same special circuitry in the controller as do the 1.2-Meg 5¼-inch drives and so cannot be used as 1.44-Meg drives by most Color Computer controllers, with the exception of the hard drive systems by Frank Hogg (Deluxe only) and Owlware. However, these 1.44-Meg drives can be used as if they were 720K 3½-inch drives, usually by simply using 720K-type disks in them and hooking them to a standard type Color Computer controller. They differ in this respect from the 5¼-inch 1.2-Meg drives, which are not usable by ordinary Color Computer Controllers.

The media for a 1.44-Meg drive has an extra notch in it opposite the write protect window. This notch typically is sensed by the drive and, if present, tells the drive to switch into 1.44-Meg mode. If the notch is not present (as is the case on 720K-type disks), most 1.44-Meg 3½-inch drives automatically switch to 720K mode and read and write in that mode in a fashion totally compatible with a plain 720K-only 3½-inch drive. The difference in magnetic coercivity of the media for a 1.44-Meg drive versus a 720K drive is far less than that between 1.2-Meg and other 5¼-inch disks. For this reason, you can notch 720K 3½-inch disks and use them as 1.44-Meg disks (if you have a controller that supports that density) or cover the notch on 1.44-Meg disks and use them as 720K disks. However, I do not recommend this.

Before 3½-inch drives were standardized, some were 40-track and some 80-track single-sided. These are weird and obsolete, but a few CoCo hackers have been known to use them. The Macintosh also uses 3½-inch disks, but it uses a mechanically and electronically different sort of drive, which is not compatible with any Color Computer disk controller.

Power Requirements

As disk drive technology advanced and disk drive size dropped, manufacturers learned how to make both motors and circuit boards for their drives that consumed less and less power. Some of the newest 3½-inch drives consume a quarter of the power of the oldest, most power-hungry 5¼-inch drives. This can become significant to those hackers who plan on tossing out an old full-height drive from a given cabinet and replacing it with newer half-height 5¼ or 3½-inch drives. Often such a maneuver will work (provided you attached the proper power connectors) but not always, especially if the power supply was marginal to begin with. It is easy to tell if your power supply has enough power capacity: Try it out and see if the voltage regulators overheat. If they get too hot to hold your finger over the heat sinks for more than a half second, consider replacing or reengineering the power supply.

In summary, the current standard 5¼-inch drive for the Radio Shack Color Computer is the half-height, 360K, 40-track (48-track-per-inch) floppy drive. Older single-sided half and full-height drives are still commonly used, however, and some more advanced users employ 720K 80-track drives, particularly under OS-9. For most users, it is impossible to use the AT style high-density 1.2-megabyte capacity 5¼-inch drives, although they can be supported under a few esoteric hard/floppy drive systems using OS-9. Many OS-9 users and some RS-DOS/*ADOS 3* users are switching over to 3½-inch drives and disks. The standard drive used is the 720K 80-track drive. While the 1.44-Meg drives cannot be used as 1.44-Meg drives on most CoCo systems, they can be employed quite nicely as 720K 3½-inch drives with standard CoCo disk controllers, provided you use 720K disks and connect them properly to the controller. Macintosh-type 3½-inch drives cannot be used on a Color Computer.

Stepping Rates

Years ago, many older full-height 5¼-inch drives and a very few of the newer half-height 5¼-inch drives were made so they could not move their heads from track to track in less than 30 milliseconds. The ancient full-height TEC brand drive supplied in the old gray case by Radio Shack was such a drive. So was the old TEAC full-height drive, some older Shugart full- and two-third-height drives, and the earliest Qume half-height drives. Most of the later full-height drives (including the Tandon TM-100) and almost all of the half-height drives (including all half-height drives by Tandy) were capable of stepping the head from track to track in six milliseconds or less. All 3½-inch drives I know of are capable of stepping their heads from track to track in three milliseconds or less.

Normal Color Computer controllers supplied by Tandy and most third-party manufacturers are electronically capable of stepping the head at speeds of 30, 20, 12 and six milliseconds per track. It is generally best to step the head at the fastest speed the drive will support — because this often means faster disk performance overall, and the drives seem to operate more smoothly when this is done. Disk Extended BASIC is hard coded to step the drives at the slowest possible speed, 30 ms per track. But most modified variants of Disk Extended BASIC, such as *ADOS*, allow you to choose the step rate. This is yet another advantage to using a customized variant of Disk Extended BASIC. OS-9, of course, allows easy changing of the step rate. Unless you have an ancient klunker of a drive, the odds are it will operate fine at a 6 ms step rate. All 3½-inch drives work fine at this setting of the operating system software.

Next month I'll continue this article, which will be more concerned with the nitty-gritty of making up a CoCo drive system and/or adding drives to an existing system. Until then, I'll catch you live on Delphi.

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For testing complicated circuit designs

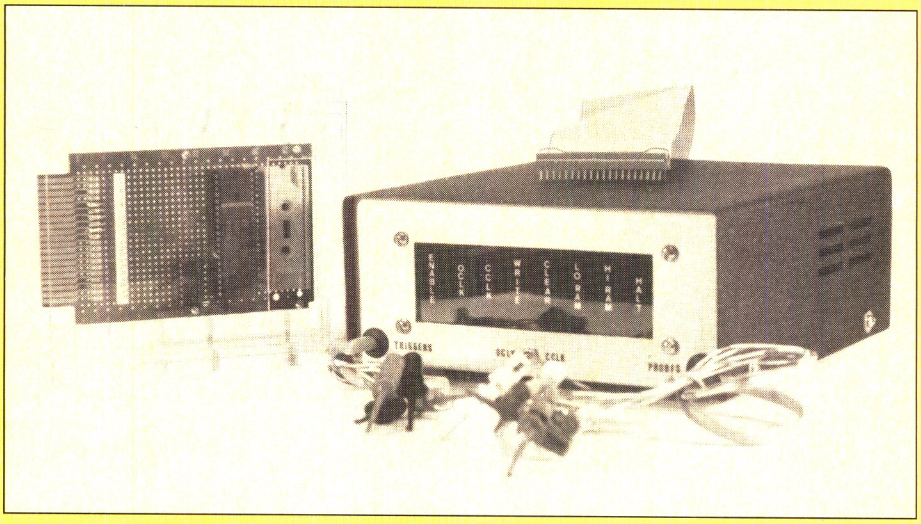
A CoCo Digital Logic Analyzer, Part 1

by Dennis H. Weide

Because of the amount of mail I receive from persons asking questions about my hardware projects, I know there are lots of CoCo enthusiasts who enjoy building peripheral equipment as much as I do.

If you're building simple circuits, the only test equipment you need is a digital logic probe and a digital multimeter. With these items and a little understanding of digital circuit design, you can build many useful and interesting CoCo projects. More complicated circuit designs, however, may require more sophisticated equipment for testing and debugging. That's where the CoCo Digital Logic Analyzer comes in. It's an easy-to-build test set that helps with circuit construction and debugging. And the system requirements are great. All you need is a 32K CoCo 1 or 2 and a cassette system. The analyzer works with a disk if you have a Multi-Pak Interface.

For those who have moved to other computers, this may be a way to put your old CoCo to work. Those who need a digital logic analyzer might want to look



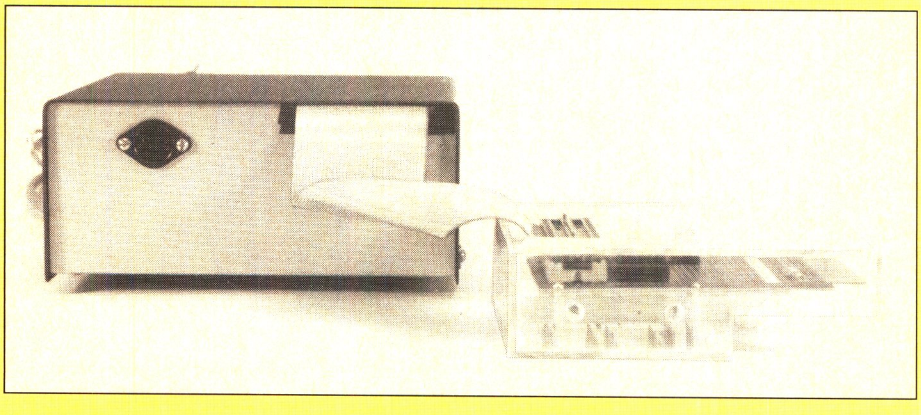


Photo 1(top). Digital Logic Analyzer (ROM cartridge shown on left in homemade case).
Photo 2. Rear view of analyzer with ROM pack plugged in. The power connector is shown on the left.

Dennis Weide is a communications technician for AT&T. His hobbies include designing, building and programming computer peripherals for disabled persons. He may be contacted at 14201 Marquette NE, Albuquerque, NM 87123.

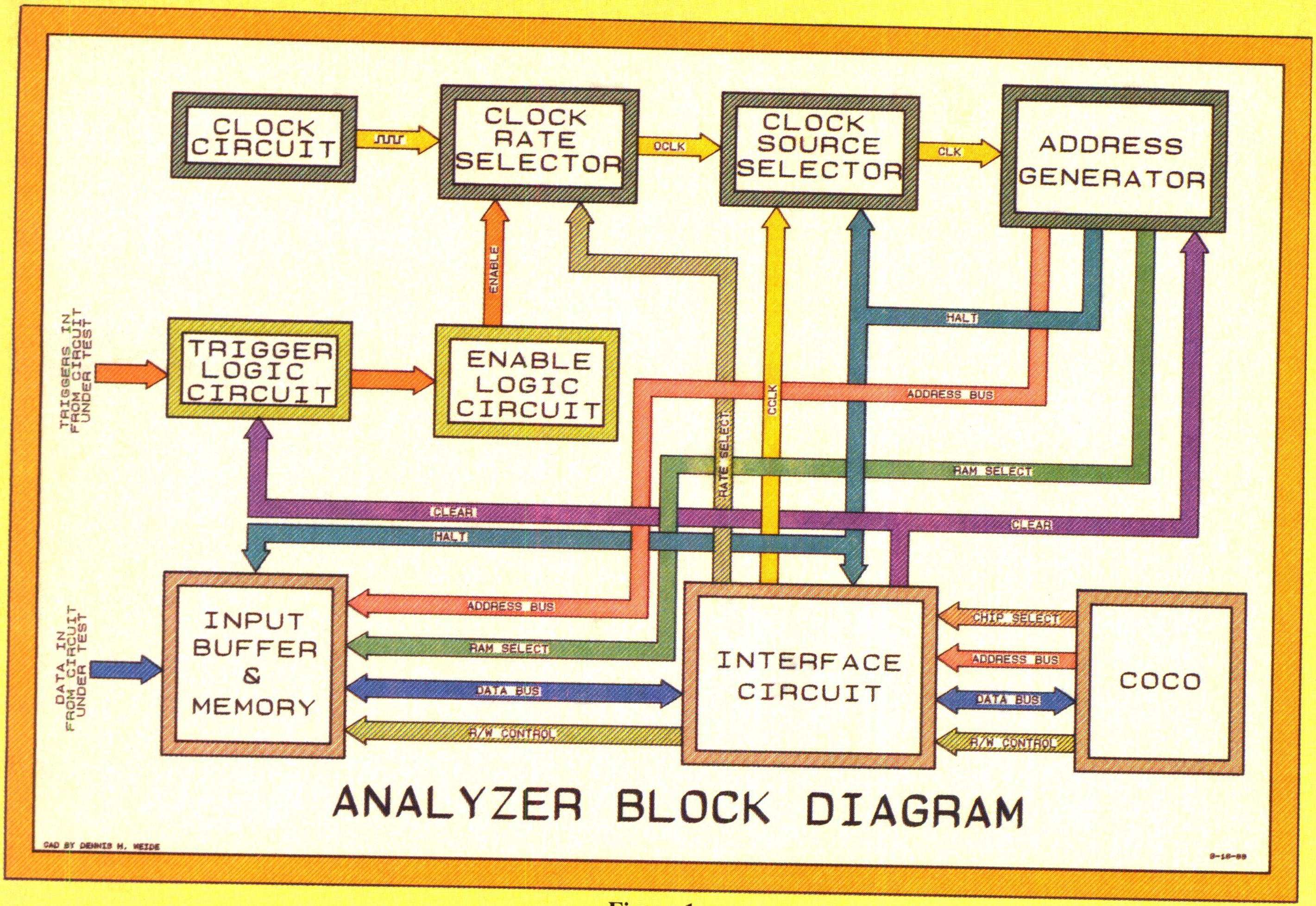

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Figure 1

around for a second CoCo for use with the analyzer. You can usually find a second-hand CoCo for around $25. A word of caution: Be sure you fully understand this project before you begin. I receive many letters and phone calls from people trying to build one of my projects who don't understand it completely. You shouldn't have any trouble understanding the project if you study it carefully and research other sources to answer general questions about circuit design and construction.

This month I cover the basic design and functions of the analyzer and start constructing and testing the hardware. Next month I'll finish the hardware, test the entire analyzer, and cover the software.

Photo 1 shows the front of the completed digital logic analyzer. Photo 2 shows the back where you can see the ribbon cable used to connect the analyzer to the ROM pack. The analyzer acts much the same as a storage oscilloscope by monitoring the condition of eight inputs connected to the TTL circuit under test. It has its own internal rate-selectable clock, address counter and static random-access memory (SRAM) allowing it to act as a stand-alone device for data collection. Eight light-emitting diodes (LEDs) mounted behind the face plate are used to provide a visual indication of analyzer activity.

Here's a brief description of how the analyzer works: When the analyzer trigger and test inputs are connected to a TTL circuit to be tested and all trigger conditions are met, the data present at the eight test inputs are stored in SRAM at the internal clock rate. When all bytes of SRAM have been loaded, the analyzer signals the CoCo that it's ready to transfer data to the CoCo's dynamic RAM (DRAM). The CoCo takes control of the analyzer clock and memory circuits and transfers the data from the analyzer to the CoCo. The data is divided into screen pages of 240 time slots per page. Each time slot represents one byte of collected data. You can select the first time slot to be displayed on the screen. The enhanced data displayed on the screen resemble eight oscilloscope traces. You can add cursors to the screen display and move them back and forth for reference purposes. Several commands are available to allow you to select program options and screen pages as needed. I'll explain more about that when we cover the programs used in the system.

Block Diagram

Figure 1 is the analyzer block diagram. The block labeled CoCo is, of course, an unmodified TRS-80 Color Computer 1 or 2. A CoCo 3 can be used, but it requires some hardware and software modifications.

All information passed to or from the computer must pass through the interface circuit. This circuit simplifies the tasks of connecting the computer to the analyzer and programming the computer.

The clock circuit generates the square wave used to increment the address generator. This square wave is sent to the clock rate selector circuit, which allows the user to select the rate at which the test data is stored in SRAM. Because of its slow clock speed (less than 1 MHz), the CoCo cannot provide clocking for the data to be collected. The analyzer must operate at a speed at least five times greater than the circuit being tested to provide an acceptable display resolution.

The clock source selector circuit allows the user to select the internal clock (OCLK) or the computer-generated clock (CCLK) by means of a switch. The OCLK is used during data collection. The CCLK is a function of the software and is used during data transfer from the analyzer to the computer.

The trigger logic circuit provides the ability to trigger the analyzer from three different trigger sources.

The triggers required from the circuit under test are passed through the trigger logic circuit to the enable logic circuit. The trigger logic circuit provides the ability to trigger the analyzer from three different trigger sources. Two of these triggers are active high and one is active low. Unused triggers should be connected to the proper logic level during testing. The trigger output from the trigger logic circuit triggers the enable logic circuit that generates the ENABLE pulse, allowing the clock rate selector to pass the clock signal to the clock source selector. The clock source selector is a DPDT switch that selects the OCLK signal during data collection and the CCLK signal during data transfer. The output of the clock source selector is called the CLK signal and is passed along to the address generator.

The address generator provides the addressing needed by the SRAM during data collection and transfer. It also provides the RAM SELECT signal that selects the SRAM currently being accessed. During data transfer from the analyzer to the computer, the address generator is incremented by the CCLK signal so the data transfer can take place under software control.

The input buffer and memory circuit provide the storage capabilities and isolation from the circuit under test. During data collection, the input data passes through the buffer into the SRAM at the clock rate. The address generator increments once for each cycle of the clock circuit. When all bytes of the SRAM have been written to, the HALT signal from the address generator locks the input buffer into the high-impedance state so data stored in SRAM is not destroyed. A CLEAR signal initializes the address bus after data collection and transfer.

Port	Function	Address
A	INPUT	$FF40
B	OUTPUT	$FF41
C	IN/OUT	$FF42
I	IREG	$FF43

Table 1: Analyzer PPI Port Assignments

Flowcharts

In order to simplify the overall design, it was necessary to create flowcharts to assist

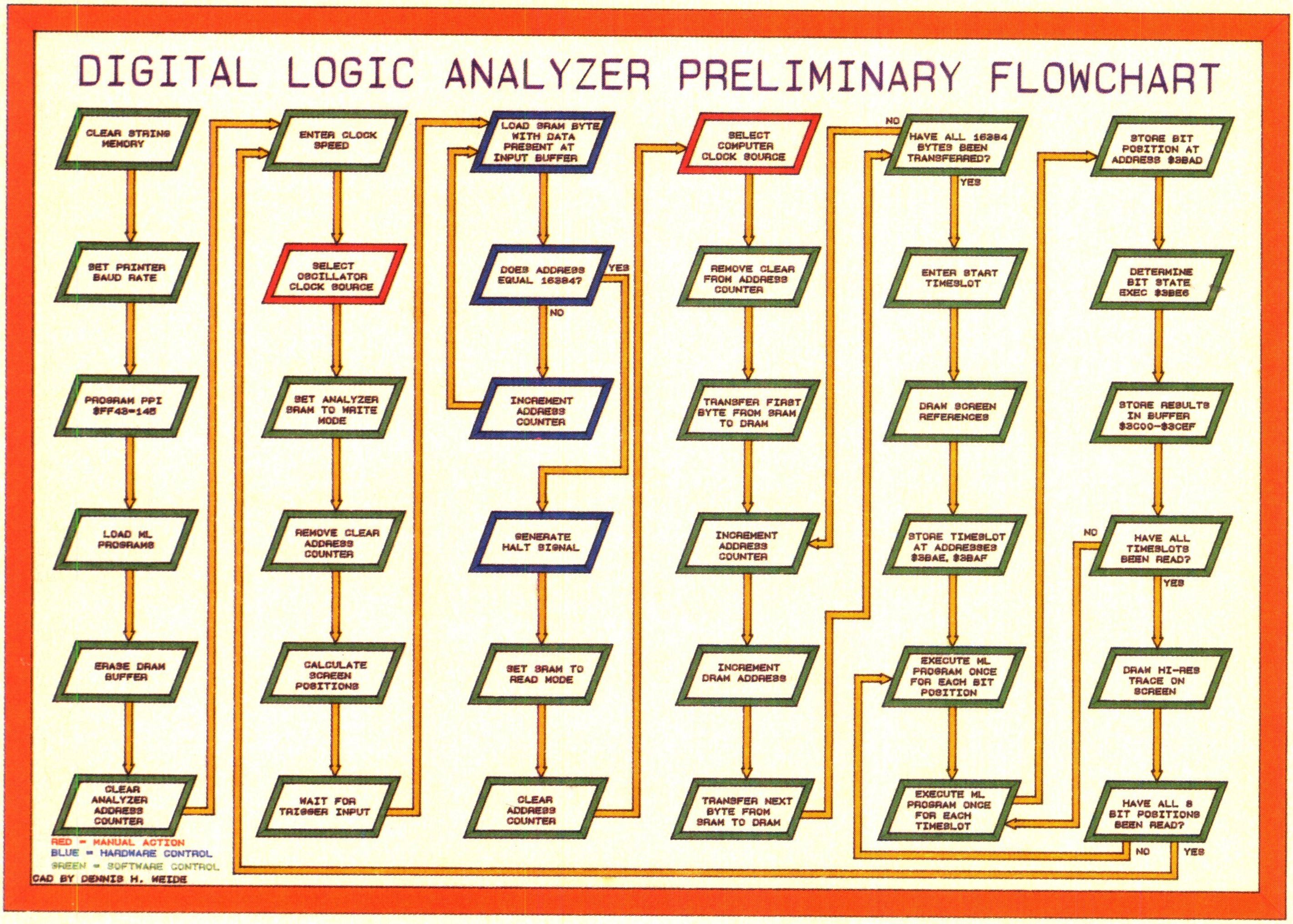
DIGITAL LOGIC ANALYZER PRELIMINARY FLOWCHART
CLEAR STRING MEMORY
SET PRINTER BAUD RATE
PROGRAM PPI $FF43=145
LOAD ML PROGRAMS
ERASE DRAM BUFFER
CLEAR ANALYZER ADDRESS COUNTER
ENTER CLOCK SPEED
SELECT OSCILLATOR CLOCK SOURCE
SET ANALYZER SRAM TO WRITE MODE
REMOVE CLEAR ADDRESS COUNTER
CALCULATE SCREEN POSITIONS
WAIT FOR TRIGGER INPUT
LOAD SRAM BYTE WITH DATA PRESENT AT INPUT BUFFER
DOES ADDRESS EQUAL 16384?
YES
NO
INCREMENT ADDRESS COUNTER
GENERATE HALT SIGNAL
SET SRAM TO READ MODE
CLEAR ADDRESS COUNTER
SELECT COMPUTER CLOCK SOURCE
REMOVE CLEAR FROM ADDRESS COUNTER
TRANSFER FIRST BYTE FROM SRAM TO DRAM
INCREMENT ADDRESS COUNTER
INCREMENT DRAM ADDRESS
TRANSFER NEXT BYTE FROM SRAM TO DRAM
NO
HAVE ALL 16384 BYTES BEEN TRANSFERRED?
YES
ENTER START TIMESLOT
DRAW SCREEN REFERENCES
STORE TIMESLOT AT ADDRESSES $3BAE, $3BAF
EXECUTE ML PROGRAM ONCE FOR EACH BIT POSITION
EXECUTE ML PROGRAM ONCE FOR EACH TIMESLOT
STORE BIT POSITION AT ADDRESS $3BAD
DETERMINE BIT STATE EXEC $3BE6
STORE RESULTS IN BUFFER $3C00-$3CEF
NO
HAVE ALL TIMESLOTS BEEN READ?
YES
DRAW HI-RES TRACE ON SCREEN
HAVE ALL 8 BIT POSITIONS BEEN READ?
NO
YES
RED = MANUAL ACTION
BLUE = HARDWARE CONTROL
GREEN = SOFTWARE CONTROL
CAD BY DENNIS H. WEIDE

Figure 2

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- GR1 - 12 Basic Graphic Programs
- GR2 - 12 Basic Graphic Programs
- GR3 - 9 Coco 3 Graphic Programs
- GR4 - 22 Coco Max Pictures
- GR5 - 22 Coco Max Pictures
- GR6 - 22 Coco Max Pictures
- GR7 - 15 Coco Max Pictures
- GR8 - 22 .Bin Pictures
- GR9 - 22 .Bin Pictures
- GR10 - 14 Large .Bin Pictures
- GR11 - 8 Mge Pictures
- GR12 - Coco Max 3 Pictures
- GR13 - Macpaint Graphic Editor
- GR14 - 5 Macintosh Pictures

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- E2 - 12 Programs For High School Kids
- E3 - 11 Programs Teaching The Coco'S Commands
- E4 - 5 Graphics Programs About Australia

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M5	GR5		U5	GA5
M6	GR6	H1	U6	GA6
M7	GR7	H2	U7	GA7
	GR8	H3	U8	GA8
A1	GR9	H4		GA9
A2	GR10			GA10
	GR11			GA11
T1	GR12			
T2	GR13			
T3	GR14			

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in the initial design. By doing this, many potential errors are discovered before any major design or construction begins.

Figure 2 is the preliminary system flowchart for the entire Digital Logic Analyzer. The boxes are color-coded to indicate the three different types of control used in the system: Green boxes indicate computer-controlled functions; blue boxes indicate analyzer-controlled functions; and red boxes indicate manually-controlled functions. The analyzer can be modified so the manually-controlled functions become computer-controlled. Start at the top of the flowchart and follow along as I explain the operation of the system.

After the BASIC program (to be presented next month) is loaded into memory and run, the computer parameters are set. String memory is set aside by the `CLEAR` statement and the printer baud rate is set. Then the interface circuit is configured for proper operation with the analyzer. Machine language programs are poked into computer memory by the BASIC program. DRAM is used by the computer as a temporary buffer so it must be erased. The analyzer address counter is set to zero so the first SRAM address can be written to. The computer prompts the user to enter the desired clock speed and switch the clock source selector switch on the analyzer to the OCLK position. Then the analyzer SRAM is set to the Write mode, and the CLEAR signal is removed from the address generator to allow data collection. The analyzer is then active and waits for a trigger to start data collection. The computer calculates the screen starting positions for the eight traces and waits for a HALT signal from the analyzer.

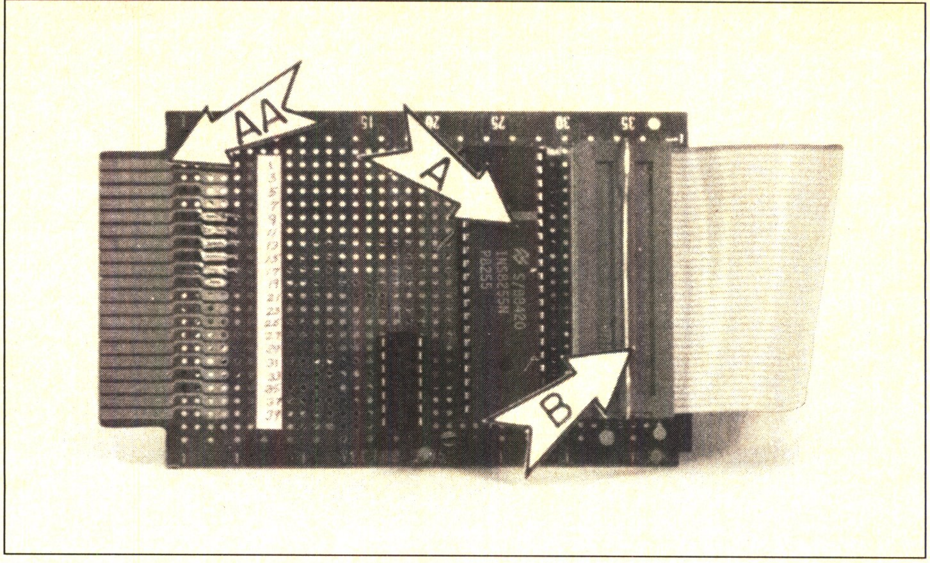

Photo 3. Top of interface board. A: 8255 PPI. B: Ribbon cable plugged into 40-pin DIP socket. AA: Pin 1 on circuit card.

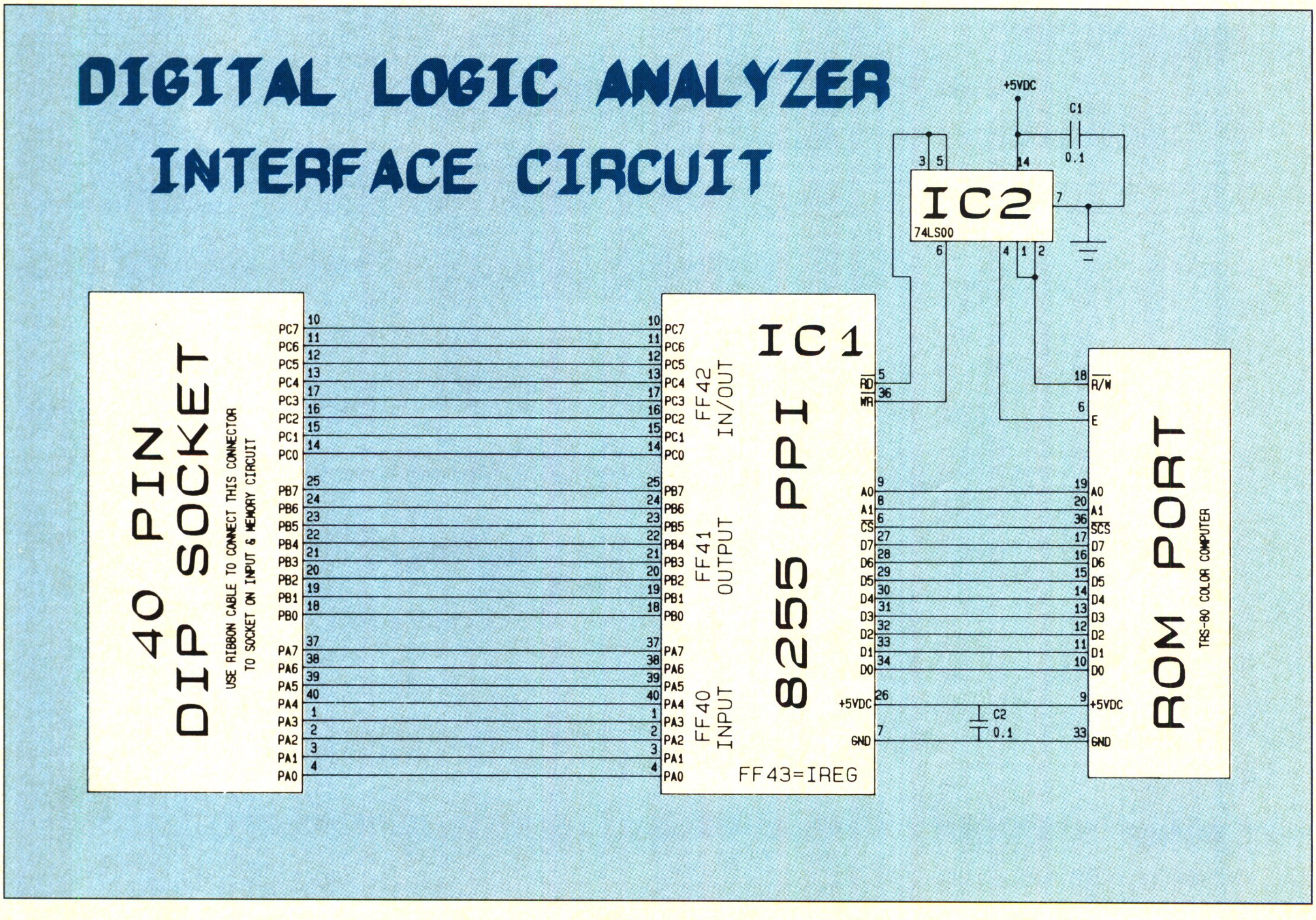
DIGITAL LOGIC ANALYZER
INTERFACE CIRCUIT
+5VDC
C1
0.1
IC2
74LS00
3 5
14
7
6
4 1 2
40 PIN
DIP SOCKET
USE RIBBON CABLE TO CONNECT THIS CONNECTOR
TO SOCKET ON INPUT & MEMORY CIRCUIT
PC7 PC6 PC5 PC4 PC3 PC2 PC1 PC0
PB7 PB6 PB5 PB4 PB3 PB2 PB1 PB0
PA7 PA6 PA5 PA4 PA3 PA2 PA1 PA0
IC1
8255 PPI
FF42 IN/OUT
FF41 OUTPUT
FF40 INPUT
FF43=IREG
RD 5
WR 36
A0 A1 CS D7 D6 D5 D4 D3 D2 D1 D0
+5VDC
GND
C2
0.1
ROM PORT
TRS-80 COLOR COMPUTER
R/W
E
SCS
+5VDC
GND

Figure 3

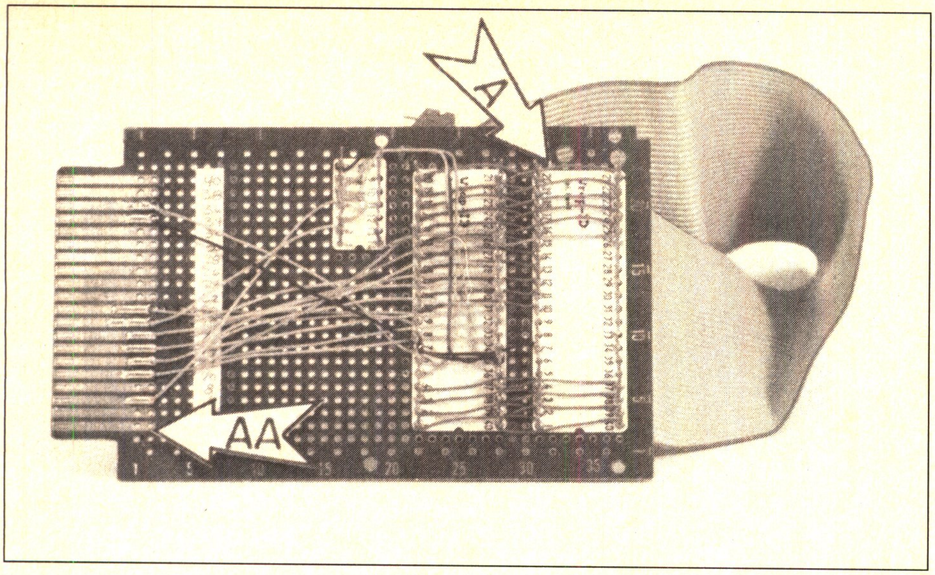

Photo 4. Bottom of interface board. A: Bottom of 40-pin DIP socket. AA: Pin 2 on circuit board.

Once a proper trigger state is detected at all trigger inputs, the analyzer is enabled and data collection begins. The data present at the input buffer is transferred to the first SRAM byte, and the address counter is incremented at the clock rate. After each increment of the address counter, the data present at the input buffer is transferred to the current SRAM address until all 16,384 bytes have been loaded with data. The HALT signal prevents further data collection and is also sent to the computer to restart processing. The computer sets the SRAM to the Read mode, clears the address counter back to zero, and prompts you to move the clock source switch to CCLK. The computer increments the address counter at the rate required to transfer data from SRAM to DRAM. The first byte of SRAM is transferred to DRAM, and the address counter and DRAM address are incremented. Data transfer continues until all 16,384 bytes of analyzer SRAM have been transferred to the CoCo DRAM. Then the computer prompts you to enter the time slot you want to view. After you've done this, screen references are drawn on the `PMODE 4` screen; and the time slot information you've entered is poked into memory for use by the machine language programs.

Two ML programs are executed to read each bit position for the 240 time slots being displayed. These programs determine the state of the bits and store the results in a small buffer for processing by the BASIC program. After all 240 time slots have been read, the BASIC program reads the information out of the small buffer and draws the trace on the screen. The process is duplicated for all eight bits. After all traces have been drawn on the screen, the program returns to the Clock Speed prompt.

Many enhancements have been added to the BASIC program to allow the use of cursors, as well as to display start and end time slots. The flowchart shown was used to design the analyzer and gives a good picture of how the system works.

The Schematics

Now let's take a look at the circuit schematics. Figure 3 is the schematic diagram for the interface circuit. If it seems familiar to veteran RAINBOW readers, it's because I've used it before in several other CoCo hardware interfacing projects. The original interface circuit idea came from Bill Barden.

Part #	Description
IC1	8255 PPI chip
IC2	74LS00
SOCKET	40-Pin wirewrap socket
Misc	40-conductor ribbon cable with connectors,*PC board, wire, IC sockets

*Note: PC board (JE413) and most parts are available from Jameco Electronics, 1355 Shoreway Road, Belmont, CA 94002; (415)592-8097.

Table 2: Interface Circuit Parts List

IC1 is an 8255 PPI chip, a 40-pin chip that greatly simplifies system design. The 8255 PPI allows the CoCo ROM port to address three external 8-bit ports (ports A, B and C). For the analyzer circuit, the port assignments are listed in Table 1. By using peeks and pokes to these addresses, you can access peripheral equipment connected to the 8255 ports.

IC2 is used to decode the CoCo R/*W (Read/Write) signal to provide the separate Read and Write leads required by the 8255 PPI chip.

The three PPI ports are connected to a 40-pin DIP socket as shown. A ribbon cable connects the interface circuit to the analyzer. The interface circuit plugs directly into the CoCo ROM port and is powered by the CoCo. This is necessary to reduce the possibility of outside interference caused by extending the CoCo address or data bus beyond the ROM port.

Part#	Description
74LS240	Tri-state octal driver
HI	Red diffused rect. LED
LO	Red diffused rect. LED
Resistors	100 ohm, ¼w resistor
Resistor	1K ohm, ¼w resistor
C1	.1 mfd cap.
SPDT	Toggle switch
IN1-IN8	Micro test clips
Misc	30-gauge wire, project case,20-pin DIP socket

Table 3. Parts List for 8-bit Logic Indicator

Constructing the Interface Board

Construction of the interface board is easy, but it may be difficult to find a circuit board to fit the CoCo ROM port. I used a JE413 board from Jameco Electronics (see parts list), which I modified to fit the CoCo. You can use any double-sided circuit board with at least 40 pins (20 on each side) on .1-inch centers. If your board has more than 40 pins, it is necessary to trim off the unused pins, which is best done with a file. Trim a little bit at a time and keep checking the fit to ensure a snug connection.

You can use either wire-wrapping or point-to-point wiring techniques, although I recommend wire-wrapping. Construction and parts placement are not critical, but keep wires short to allow the analyzer to work at the highest possible speed. Photo 3 shows the top of the interface board, and Photo 4 shows the bottom. If you wire-wrap, use a complete power and ground loop and solder these connections. This prevents circuit malfunctions caused by high-resistance connections. Table 2 is the parts list for the interface circuit.

Testing the Interface Circuit

Once you've wired and checked the construction of the interface circuit, it's time to test it by poking the three port addresses and checking the condition of the ports with a logic probe. Program Listing 1 is a simple program for setting each bit of each port. Figure 4 is a homemade 8-bit logic tester I built to test the analyzer circuits. Two rows of LEDs provide High and Low logic indications. Table 3 is the parts list for the 8-bit logic tester. Use the program in Listing 1, the logic tester, and the procedure below to test the interface.

32 K Extended

The Listing: TESTIF

```
0 'COPYRIGHT 1989, FALSOFT INC.
10 'PROGRAM TO TEST INTERFACE
CIR
CUIT
20 CLS:POKE &HFF43,128
30 INPUT "ENTER TEST ADDRESS IN
HEX >";A$
40 A$="&H"+A$
50 A=VAL(A$)
60 POKE A,0
70 FOR X=0 TO 7
80 FOR Y=1 TO 50:NEXT Y
90 POKE A,2^X
100 NEXT X
110 GOTO 60
```

- Turn off the computer power.
- Plug the interface board into the ROM port.

Logic Indicator Input	Address FF40 Pin	Address FF41 Pin	Address FF42 Pin	Bit Number
1	4	18	14	0
2	3	19	15	1
3	2	20	16	2
4	1	21	17	3
5	40	22	13	4
6	39	23	12	5
7	38	24	11	6
8	37	25	10	7
+5v	26	26	26	
GND	7	7	7	
Trig	7	7	7	

Note: Connect the logic indicator inputs as shown above.

Table 4. Logic Indicator Test Connections

- Connect the logic tester to Port A per Table 4.
- Turn on the computer power.
- Type in and run the program in Listing 1.
- The logic indicator should show all bits low and then set each bit high one at a time. This cycle continues until you press BREAK.
- Now change Line 80 of the program as follows:

```
80 POKE A,PEEK(A)+2^X
```

- Run the program again. All bits should start out low and go high and remain high, one at a time. This cycle continues until you press BREAK.
- Repeat the test for each address as listed in Table 4.

Next month I'll finish this project, but in the meantime study this information. I'm sure hardware hackers will find it a lot of fun.

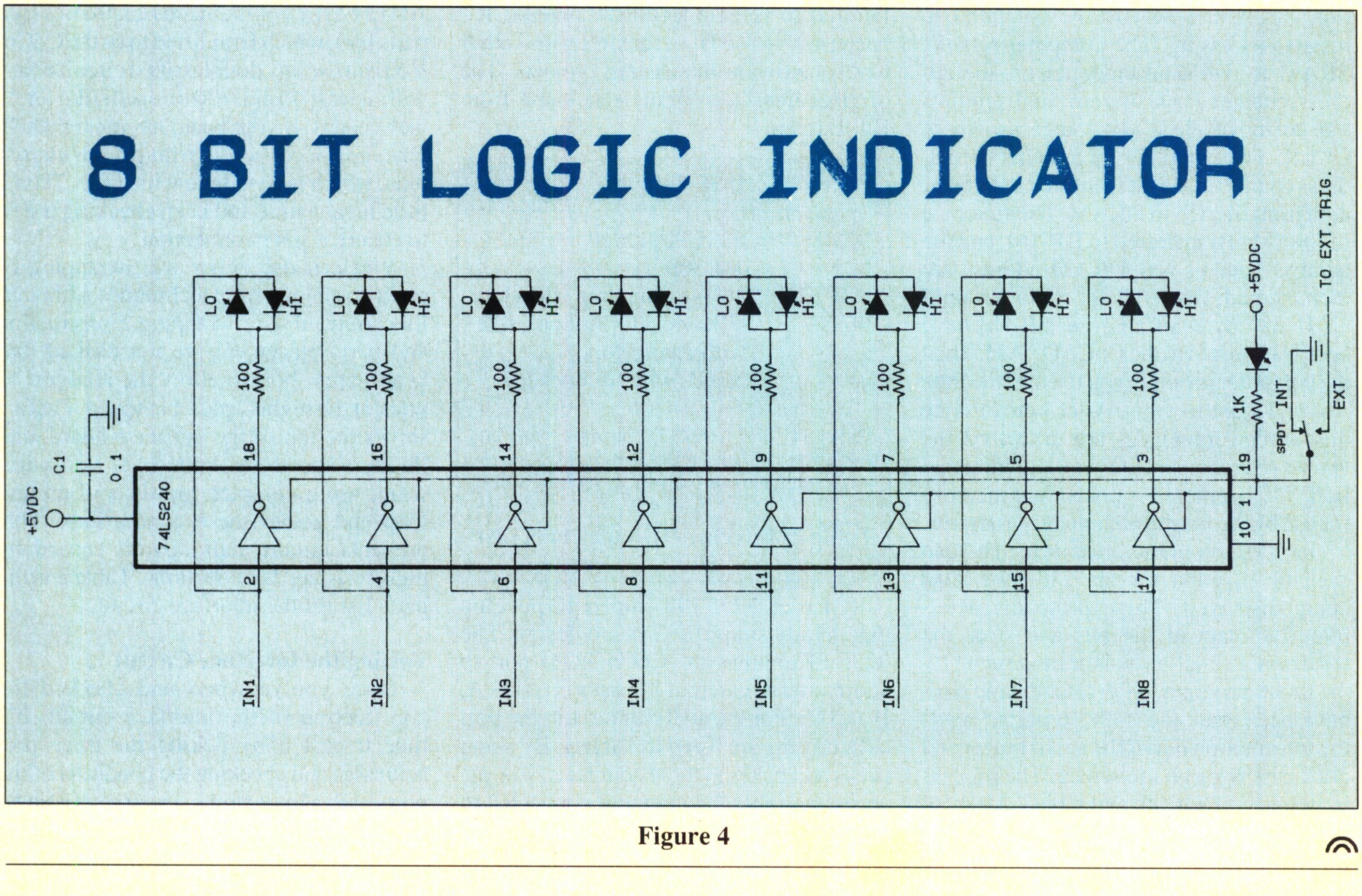

Figure 4

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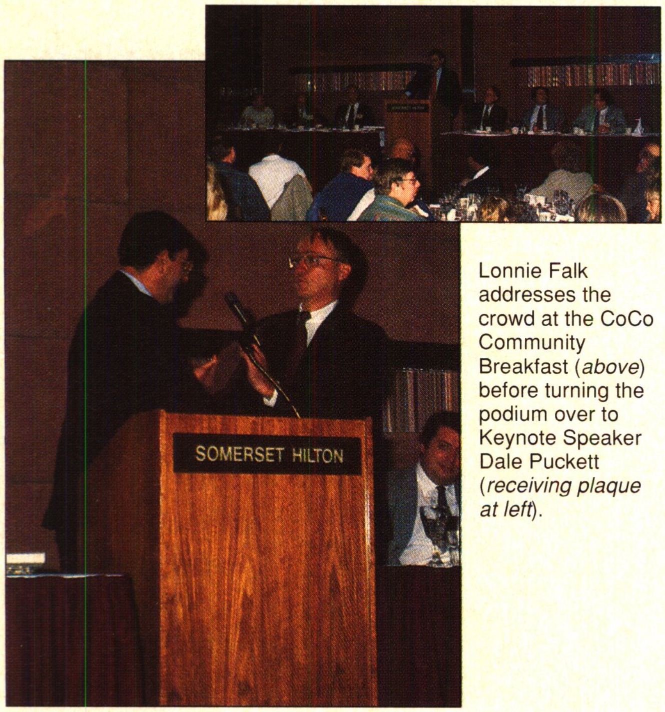
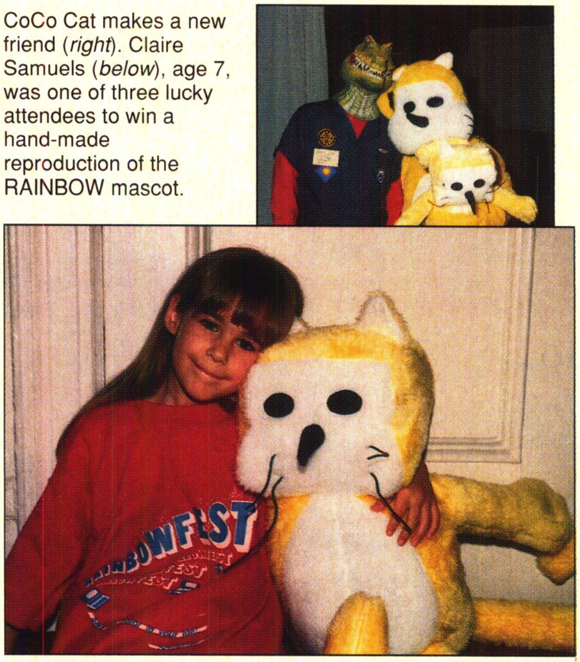


Lonnie Falk addresses the crowd at the CoCo Community Breakfast (*above*) before turning the podium over to Keynote Speaker Dale Puckett (*receiving plaque at left*).



CoCo Cat makes a new friend (*right*). Claire Samuels (*below*), age 7, was one of three lucky attendees to win a hand-made reproduction of the RAINBOW mascot.

RAINBOWfest Somerset buzzed to life on October 20, 1989. Hundreds of people formed a line in the hallway as they eagerly awaited the opening of the doors to the exhibit hall at 7:00pm. Many RAINBOW celebrities including Dale Puckett, Tony DiStefano and Falsoft publisher Lonnie Falk were on hand. Tandy executives Ed Juge and Mark Siegel were there also, and the CoCo Cat was at large in the crowd, greeting youngsters and making friends with excited showgoers.

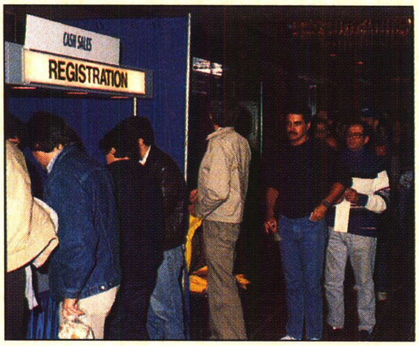
The CoCo Community Breakfast on Saturday honored Dale Puckett as the keynote speaker. Dale gave a charming and humorous recounting of his long involvement with OS-9 and computers and included some humorous anecdotes about the beginnings of OS-9.

For CoCo education, high points at the Somerset show included seminars by such notables as Marty Goodman, Kevin Darling (OS-9 Users Group president), Steve Bjork and Mike Knudsen (author of the OS-9 MIDI program, *UltiMusE III*).

Tandy also sponsored a talk-to-Tandy open house during which four new Program Pak software titles were introduced. These are *Robocop*, *Rampage*, *Predator* and *Arkanoid*.

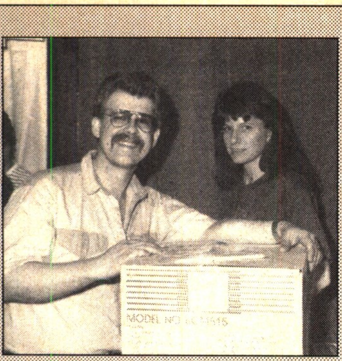
After the exhibit hall closed Saturday evening, many attendees joined in the fun at the Delphi Saturday Night bash. CoCo and OS9 Online SIG members welcomed nonmembers to the festive gathering.

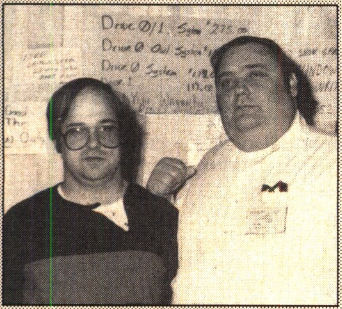
There were few tears but some long goodbyes as the show drew to a close Sunday afternoon. It was an exciting show and, as they packed their booths for the trip home, the exhibitors made their return promises — we'll see you in Chicago in April.

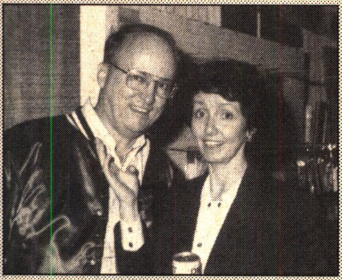


Thousands traveled from across the continent to join the festivities at the 18th RAINBOWfest.

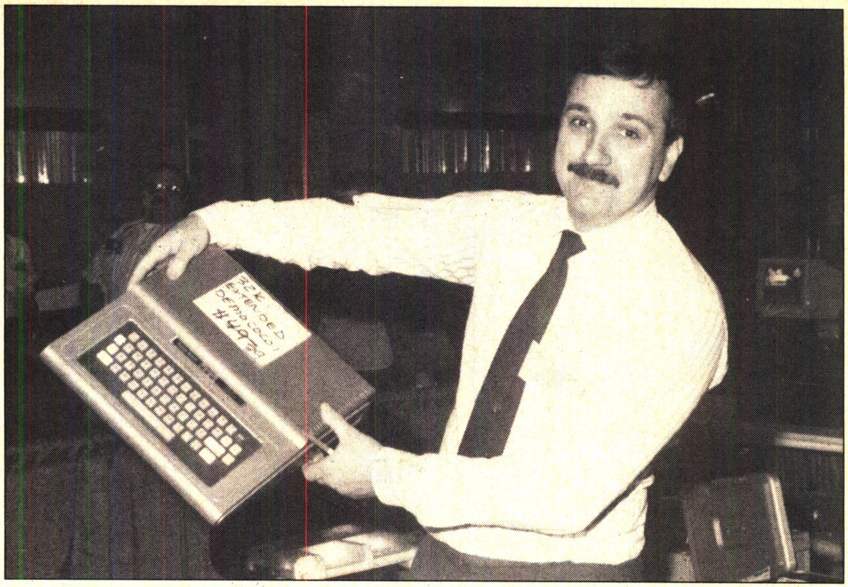
Bonnie Frowenfeld, general manager at Falsoft, sells the last of *The Complete RAINBOW Guide to OS-9 Level II* books.



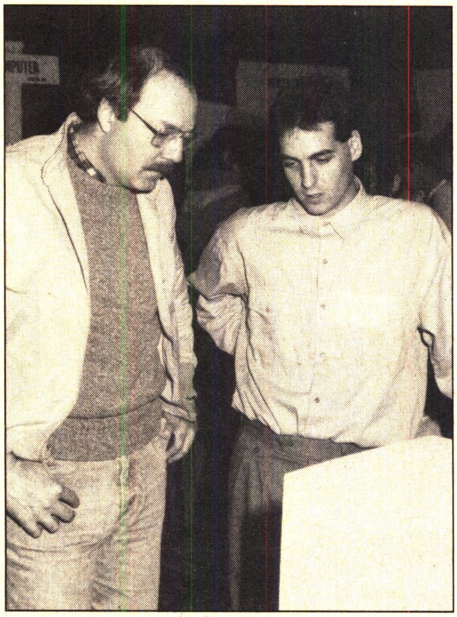




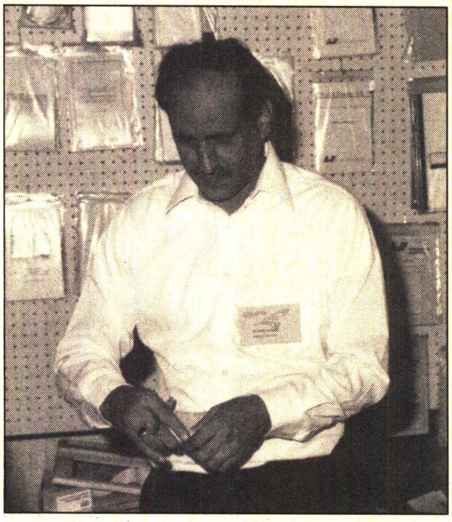
Top: Dave and Nancy Myers, along with Lemar and Carol Whipperman (not pictured), brought CocoPro! to its first RAINBOWfest. CoCoPro! offers great savings on used equipment and overstock supplies.
Middle: Tom Roginski (*right*) and Bruce Navarre at the Owl-Ware booth. In addition to a mass of other hardware items, Owl-Ware brought along several hard and floppy drives. Also available was *Window Writer 1.2*, selling for $59.
Bottom: Mrs. and Mr. Esther Puckett (they call him Dale) are gearing up for work on *CoCo: An Affectionate History*, a Falsoft publication scheduled for release early in the fall of 1990.



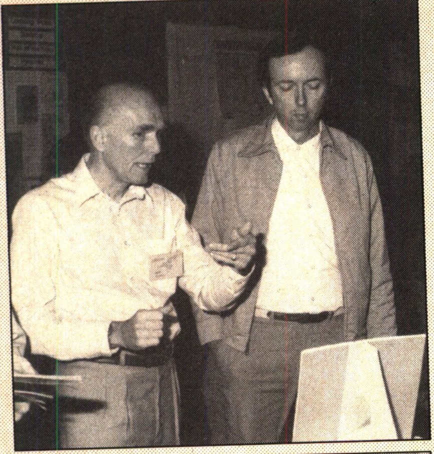
As Fran Purcell of Computer Plus shows us, CoCo 1s are still available if you look in the right places. This 32K Extended BASIC machine was selling for just $39. A long-time supporter of the CoCo, Computer Plus also offered CoCo 3s for $99 and FD-502 Drive 0s for just $175.

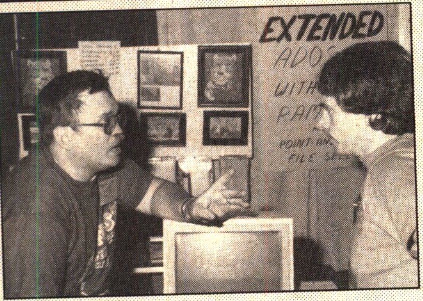


Larry Vitti (left) takes a gander at Tony DiStefano's prototype 1-Meg upgrade for the CoCo 3 with Chris Rochon, president of CRC. The upgrade adds 512K to the 512K already in an upgraded CoCo 3.



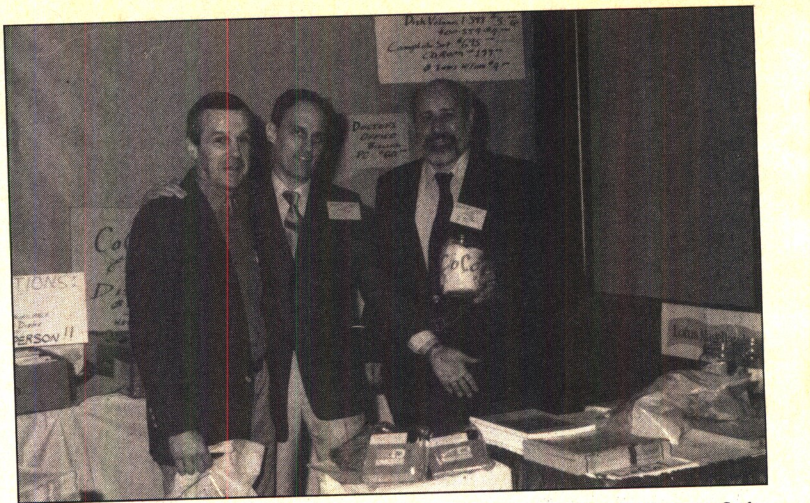
Monahar Santwani of Microcom Software stayed busy writing up sales throughout the weekend. Microcom, a company well-known for offering hard-to-find items, introduced *CIII Pages* in Somerset. This new entry into the CoCo 3 desktop publishing arena was selling for just $39 at the show. In addition, Microcom showed its support by offering its full line of utility, application and hardware products at special show prices.



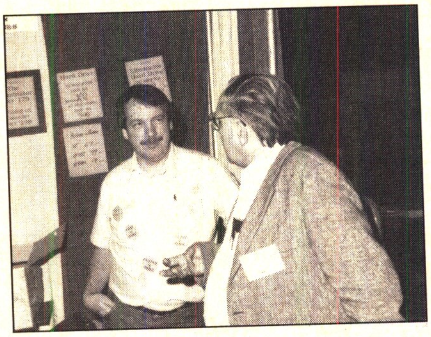


Top: Big things are happening at Danosoft. Here owner Bill Daniels (left) discusses features of *Big Filer*, Danosoft's new 512K CoCo 3 data-management program, with Tom Baker. Bill has long been a proponent of powerful business applications for the CoCo and has set up several business systems. Danosoft also provided luggage sets for door prizes. Many 'fest-goers could have used such a handy way to get their purchases home.

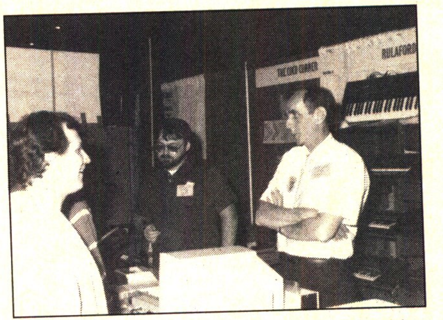
Bottom: It was Supersoft's first 'fest, but owner Joe Walker (*left*) is no newcomer to the show or the CoCo. Many attendees, including Gary Collins, wanted to find out what Supersoft's *SuperSound* and *SuperShow* are all about. These products support mixing of graphics and digitized sound for use in your own programming creations.



Winner Don Krivos with Don Johnson and Robert Vervoodt of Public Domain Software. Mr. Krivos won a complete library of public-domain offerings.



A big part of Frank Hogg Laboratories' success in backing the OS-9 community stems from Frank's ability to hear what users want. Here Chuck Davis (*right*) adds to the wish list as FHL continues to expand its OS-9 hardware/software product line.



Music and MIDI are the topics of interest at the Rulaford Research booth. Owner Cecil Houk (*right*) is helped by Jim Snider in demonstrating the capabilities of *Lyra* and *CoCo MIDI III* to the crowd. Sharing a booth with Rulaford was The CoCo Corner (not pictured), which introduced *Lyra Trax*, a whole new library of *Lyra* music files.

SPECIALTY PROJECTS

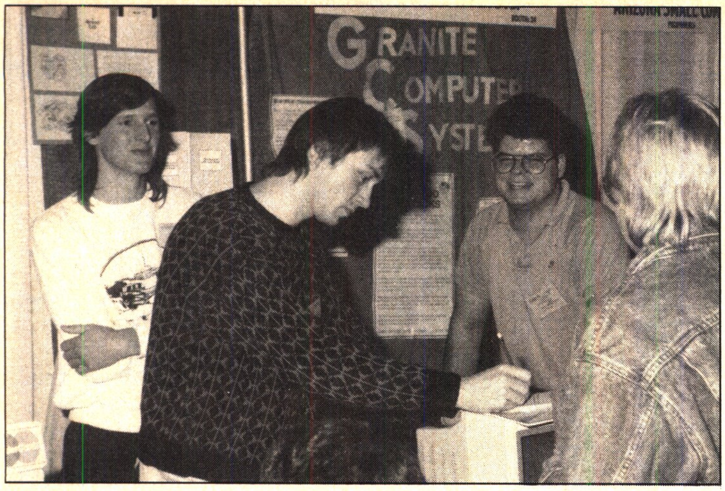
Terry Peck prepares to dig in at the Specialty Projects booth. In addition to its *Art Deli* series and *Max Templates*, Specialty projects was selling an iron-on package for putting your favorite graphics on T-shirts.

Professor Flexser's Elixir

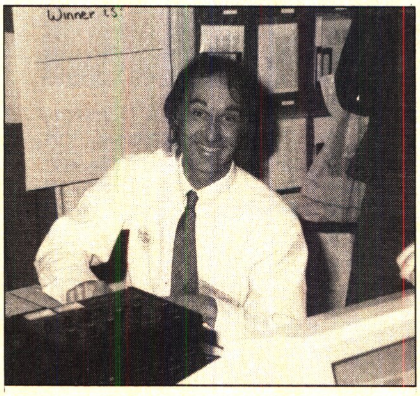
Art Flexser was on hand to demonstrate the capabilities of SpectroSystems' newly released *Extended ADOS3*. Designed to enhance the abilities of *ADOS3*, this product features a built-in RAM disk, a real-time clock interface, and the ability to support a mix of disk drive sizes. *Extended ADOS3* also allows the user to move and copy ranges of lines within a BASIC program. In addition, SpectroSystems introduced a real-time clock for *Extended ADOS3*. This unit works in any disk controller with a 28-pin ROM socket.

Welcoming Committee

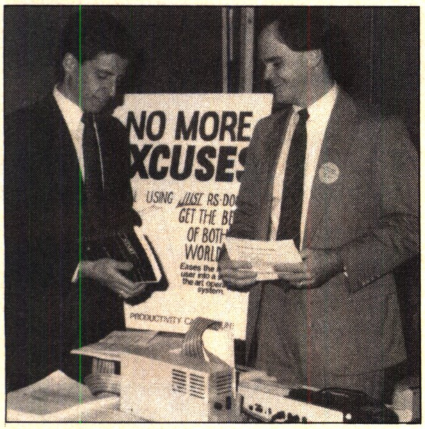
Hosting the Somerset RAINBOWfest was the Mercer County Color Computer Club. Members were providing details for club membership as well as selling the popular 'fest T-shirts. MCCCC also sponsored a raffle for a cash prize, which was won by Tom Seagrove.



Jeff Noyle and Robert Rivers of Oblique Triad introduced *Overlord*, a three-player strategy game, as well as sound disks for *Studio Works* at their second 'fest. Franz Shattuck joined in the fun while his father Gil (not pictured) demonstrated Granite Computer Systems' *File Transfer Utilities* for OS-9 Level II and *Multi-Vue*.



Meet Ed Hathaway, owner of Second City Software. Ed is the man with the plan "to support the Color Computer with practical applications in a big way." In addition to its many other offerings, Second City has taken bold steps in this direction with *Newspaper Plus* and *UltiMusE III*. According to Ed, "It won't stop there." The winner of the Studio giveaway (a Casio MT-240 w/power supply, *UltiMusE III* and a MIDI cable) was Ed Wittman.



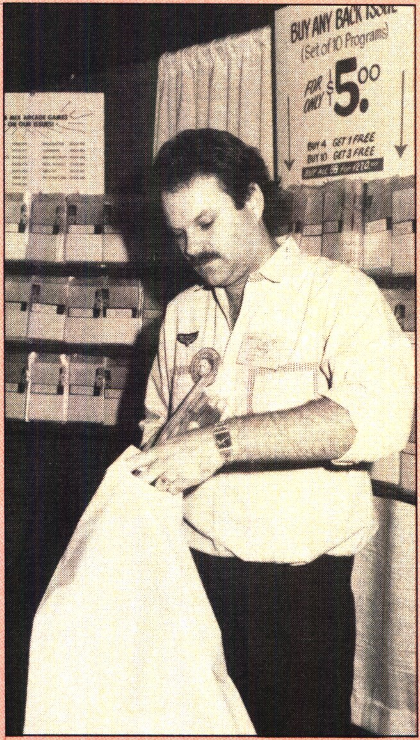
RAINBOWfest coordinator Ira Barsky gets a quick lesson in OS-9 from *Start OS-9* author Paul Ward at the Kenneth-Leigh Booth.

New from Game Point

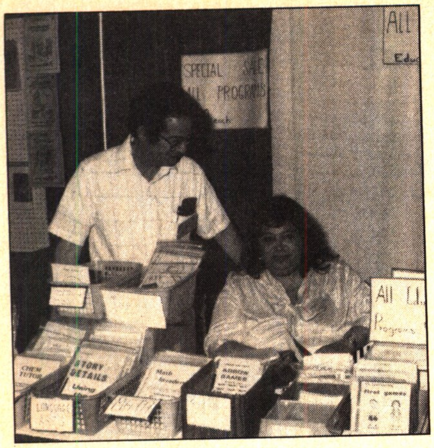
Pete Ellison, president of Game Point Software, stayed pretty busy showing the Rascan color video digitizer. But there were some new products to look at, too. Game Point brought along *Air Fox*, *Z'89* and *Quest for Thelda*, all featuring action-packed graphics. And OS-9 users were wowed with the new *MVCanvas*, a *Multi-Vue*-based graphics editor written by Mike Haaland. Mike and Game Point hope to set new standards with this entry in the applications market.

Back to BASIC

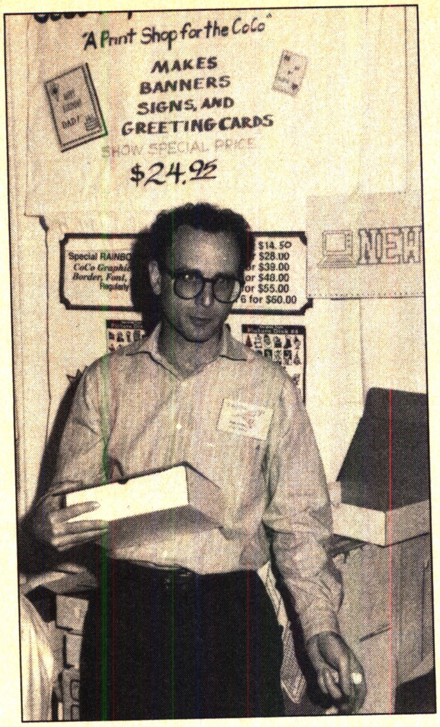
Burke & Burke exhibited its well-known line of hardware and software for OS-9 users. But the hot product was *RSB*, a program designed to allow users to run Disk BASIC programs in windows under OS-9 Level II. According to Chris and Trisha Burke, interest in *RSB* has grown rapidly. This program opens new possibilities for all CoCoists, especially those just entering the OS-9 arena.



Top: Tom Pasterniak and owner Tom DiMarco of Gimmesoft took a well-deserved break after the exhibit hall closed Saturday. Both were kept busy throughout the show demonstrating Gimmesoft's new digital audio sampler, *Studio Works*.
Bottom: Tom Dykema wraps up another bargain sale at the T & D Subscription Software booth. Having recently expanded its line, T & D was offering special discounts on their subscription software service.



RAINBOW Contributing Editor Steve Blyn and his wife, Cheryl, manned the Computer Island booth where you could choose from dozens of educational software items priced at only $10 apiece.


"A Print Shop for the CoCo"
MAKES BANNERS SIGNS, AND GREETING CARDS
SHOW SPECIAL PRICE
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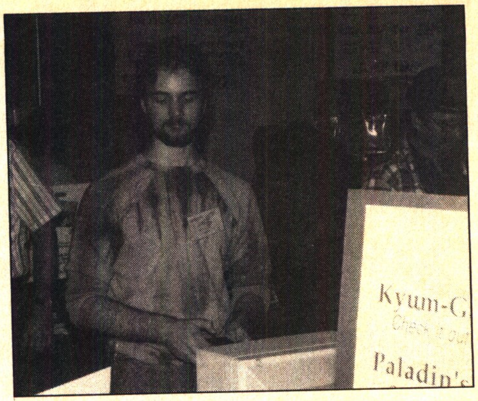
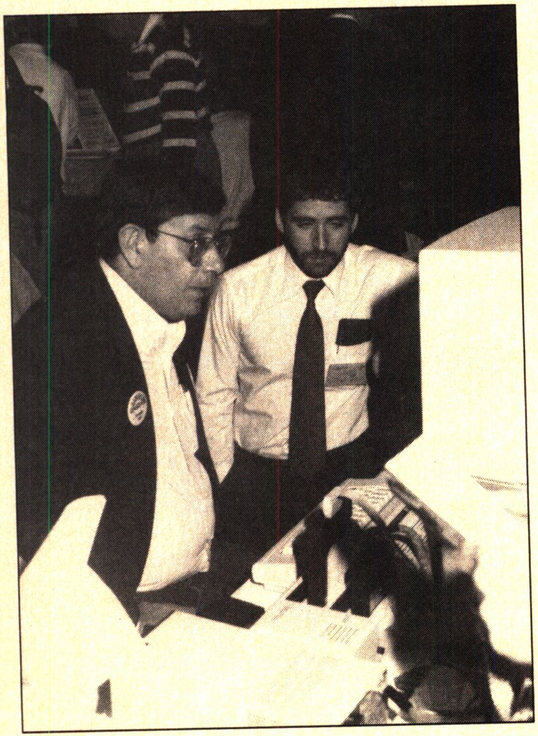
Stewart Newfeld and Zebra Systems intoduced *Label Designer* in Somerset. This label-making program features a graphics user interface, the ability to mix graphics and text on labels, and mail-merge functions.

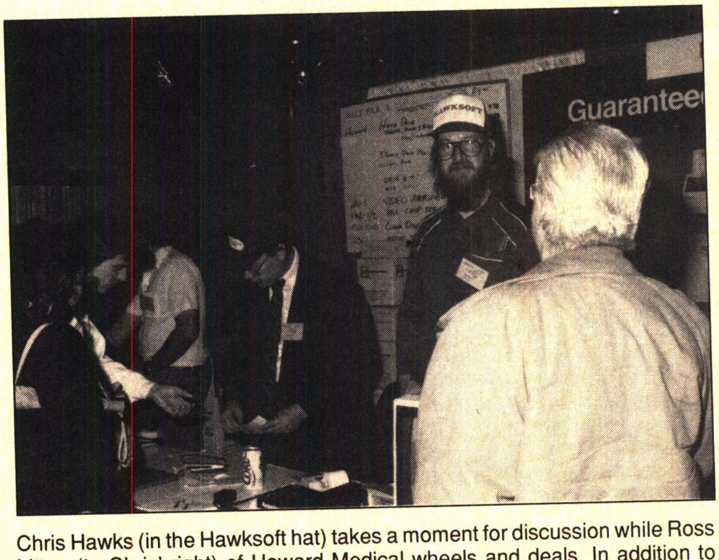


Glen Dahlgren of Sundog Systems pauses for a kick or two of his own with *Kyum-Gai: To Be Ninja*. In addition, Sundog Systems announced further support for game lovers with *Sinistaar* and *Paladin's Legacy*, two new high-quality CoCo 3 games.

Eversoft made its first appearance at the Somerset show. Here, Ken Drewry explains some of the ins and outs of Eversoft's new *Silverglade*, a graphics adventure. Also available was *Tazman*, an OS-9 adventure game.



Lonnie and Delphi marketing manager Paul Hodosh share ideas to enhance the CoCo SIG. Also representing Delphi were Robert Adams, Jon Gilbert and Marty Goodman.



Chris Hawks (in the Hawksoft hat) takes a moment for discussion while Ross Litton (to Chris' right) of Howard Medical wheels and deals. In addition to Hawksoft's other wares, Chris was showing a prototype of a compact Multi-Pak work-alike he developed. Howard Medical offered its line of hardware products including the Magnavox 8CM515 for $269 and a 10-Meg hard drive kit for $349.

CoCo Stuff

DynaStar

THE Most Popular OS-9
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"It is an excellent word processor for business and home use, whether for clerical or programming work." RAINBOW Review April 1989, Page 34. Also see July 1984, Page 220.

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OS9/68000 Includes Editor, Assembler, Debugger, Scred	$300.00
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PC-DOS UTILITY Utility to Read/Write/Format PC-DOS under OS9	99.95
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FBU Fast HD Backup (same as CoCo version)	50.00

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A CoCo Dual-Trace Oscilloscope

by William Barden, Jr.
Contributing Editor

I am stuck in a loop, it seems. I keep coming back to the beautiful analog-to-digital converter built into the CoCo — the joystick port. Those of you who read this column know that I favor reading real-world inputs through the joystick port because it's so easy; almost no external hardware is required to read temperature, light intensity, switch closures and openings, and other real-world events. Before I finish discussing the joystick port, I've got to show you one more interesting application: a CoCo 3 oscilloscope. But first, what's an oscilloscope?

Bill Barden has written 35 books and hundreds of magazine articles about small computers . His newest Color Computer book is "Connecting the CoCo to the Real World", a book of CoCo interfacing projects. He has over 20 years experience in the industry on systems ranging from mainframes to micros.

An Engineer's Favorite Tool

A basic oscilloscope displays an electrical signal plotted against time.Oscilloscopes used to be indispensable among the ranks of electrical engineers. They are still indispensable in spite of such tools as logic analyzers (microcomputers that intercept digitally coded data) but have gotten a lot smarter and faster.

Say, for example, you're interested in how a byte of

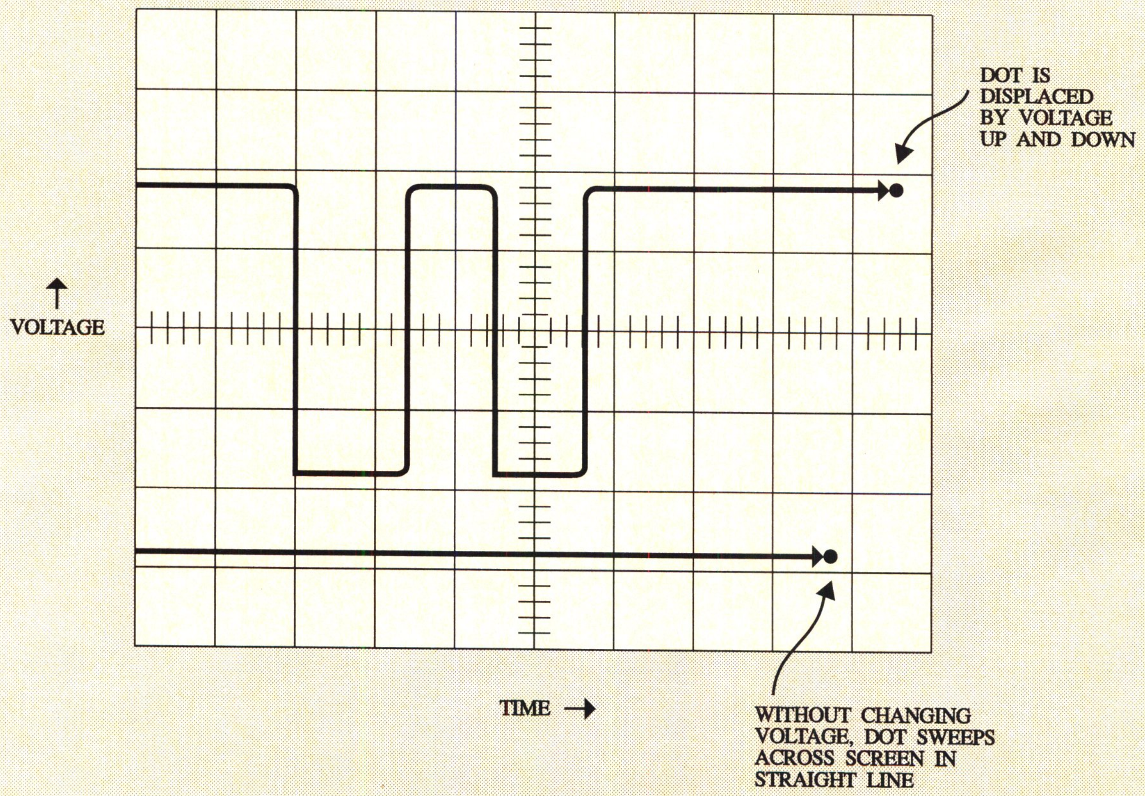

DOT IS DISPLACED BY VOLTAGE UP AND DOWN
VOLTAGE
TIME
WITHOUT CHANGING VOLTAGE, DOT SWEEPS ACROSS SCREEN IN STRAIGHT LINE

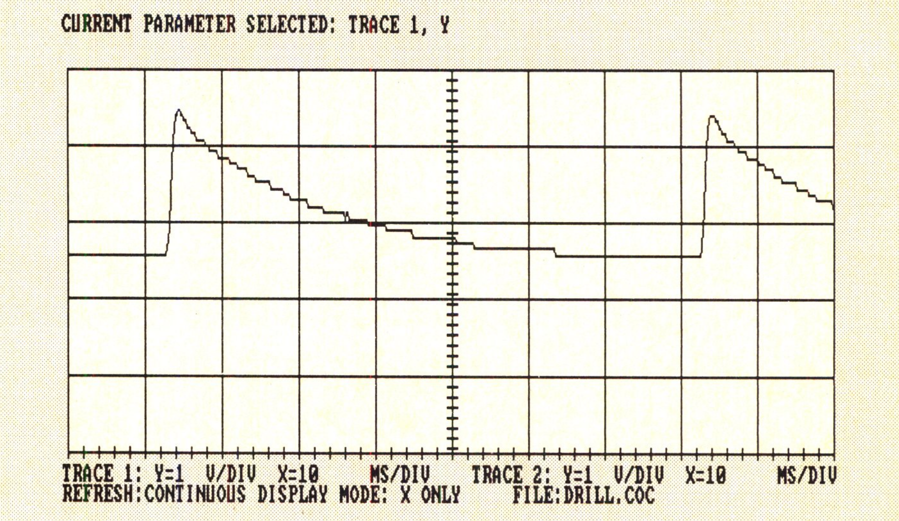
Figure 1. Oscilloscope Display

serial data appears on the serial port of the CoCo. An engineer might hook up an oscilloscope to the transmit data line of the serial port and observe the pulses of the serial data on a CRT display similar to that used in a monitor, as shown in Figure 1. The display shows a voltage plot (vertical dimension) displayed against time horizontal axis. A *trace* sweeps across the screen horizontally from left to right at a constant rate. The dot of this sweep line is moved up or down depending upon the voltage input from the signal. If the sweep line moves fast enough, the display shows a steady wave form that represents the signal. Since electrical signals vary in voltage and speed, the scope has controls to change the scale of the voltage and the sweep time. Good scopes can display waveforms of events taking place in the microsecond range (millionths of a second) and with AC or DC voltages from hundreds of volts to a few millivolts (thousandths of volts).

Many scopes have a *dual-trace* capability. Two sweep lines are used so two signals can be displayed simultaneously. With dual-trace capability you can see how electrical events relate. There are even scopes with four or eight traces to display a number of input channels at the same time.

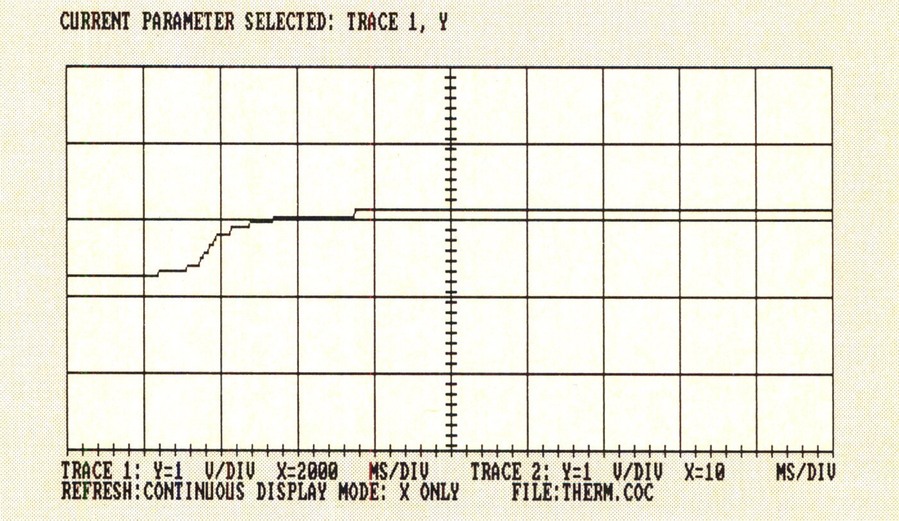
Scopes should have a high *input impedance* so that scoping a signal has little effect on the signal. The scope as a measuring instrument should be an isolated entity from the circuit it is observing.

In recent years storage oscilloscopes have become popular. These instruments capture and hold input signals in digital form and then display the inputs at any time. Typical scopes cost anywhere from $450 to $2500.



```
CURRENT PARAMETER SELECTED: TRACE 1, Y
TRACE 1: Y=1  V/DIV  X=10     MS/DIV   TRACE 2: Y=1  V/DIV  X=10     MS/DIV
REFRESH:CONTINUOUS DISPLAY MODE: X ONLY     FILE:DRILL.COC
```

Figure 2. Photocell Display



```
CURRENT PARAMETER SELECTED: TRACE 1, Y
TRACE 1: Y=1  V/DIV  X=2000   MS/DIV   TRACE 2: Y=1  V/DIV  X=10     MS/DIV
REFRESH:CONTINUOUS DISPLAY MODE: X ONLY     FILE:THERM.COC
```

Figure 3. Thermistor Display

Ideas for a CoCo 3 Oscilloscope

The idea of using a computer system to emulate an oscilloscope didn't originate with me. There are several commercial units that plug into a PC-based system and provide powerful scope functions using the PC. However, these systems are expensive — hundreds of dollars, minimum. The CoCo has even been used as an oscilloscope. Forrest Mims describes a CoCo storage oscilloscope (using a BASIC program) in his 1985 McGraw Hill book *Forrest Mims's Computer Projects*. This scope can sample about 45 events per second.

The PC-based units use a fast analog-to-digital converter to convert external signals into digital form that can be displayed. Once again, the CoCo provides built-in hardware that does the same job. The result is an oscilloscope program that does a credible job of displaying events that occur hundreds or even thousands of times per second. Figure 2 shows you what I mean. It's a display of the signal received from a cadmium sulfide photocell connected to the joystick port. By looking at the scope display, you can measure the rotational speed of a fan that interrupts a light source. The distance between peaks is about 70 milliseconds, making the rotational speed about 14.2 revolutions per second or 852 revolutions per minute.

Figure 3 shows another example: the recovery curve of a thermistor after being immersed in ice water from a room temperature starting point. This curve indicates the thermistor took about three seconds to return to ambient temperature.

Both measurements would be very difficult to make without expensive equipment. Figure 4 shows the connections required for both applications.

There are many other applications for which the scope can be used, especially if you use the joystick port for your own real-world applications, as I've described in some of these columns. All that's required is a butchered joystick cable with alligator clips connected to the leads and a few components worth less than $5. *Scope* is meant to be run on a 128K CoCo 3, which provides the high-resolution graphics.

Implementing the Scope

As usual the implementation of a scope turned out to be a horrendous task. The paramedics tell me I was mumbling something about numbers of conversions per second and assembly language bugs. Anyway, I recovered in time to write up the following.

As you may know, the CoCo uses a Read Joystick subroutine in BASIC ROM to read all four joystick channels: Right Joystick X, Right Joystick Y, Left Joystick X and Left Joystick Y. However, the ROM Read Joystick subroutine cannot be used; it's simply too slow, reading only a few dozen samples per second. What's the answer to a higher-speed joystick read?

The Assembly Language Code

Unfortunately, the answer is an assembly language subroutine. I say unfortunately because learning how to code in assembly language is a whole book in itself. In this column, however, I used an old programmer's axiom: "Steal code whenever possible." Lest you be too shocked, though, I'll tell you that I stole the code from myself — an existing assembly language subroutine to read one joystick channel. The modified form of the program is shown in Listing 1.

This subroutine has two halves: The first half reads the Right Joystick X and the second half reads the Right Joystick Y. The guts of each half are identical. The Left Joystick could also have been read, but I considered a dual-trace scope sufficient.

Each joystick value consists of six bits in the form VVVVVV00. Six bits allow joystick values of 000000 through 111111 (Decimal 0 through 63), providing 64 levels of voltages that can be read. Input voltages to the joystick port range from 0 volts to 5 volts — any device that outputs this range of voltages can be easily used in place of a joystick as you've seen in this column.

Things go fast at assembly language speeds. Each half of the subroutine reads the current joystick input in about 130

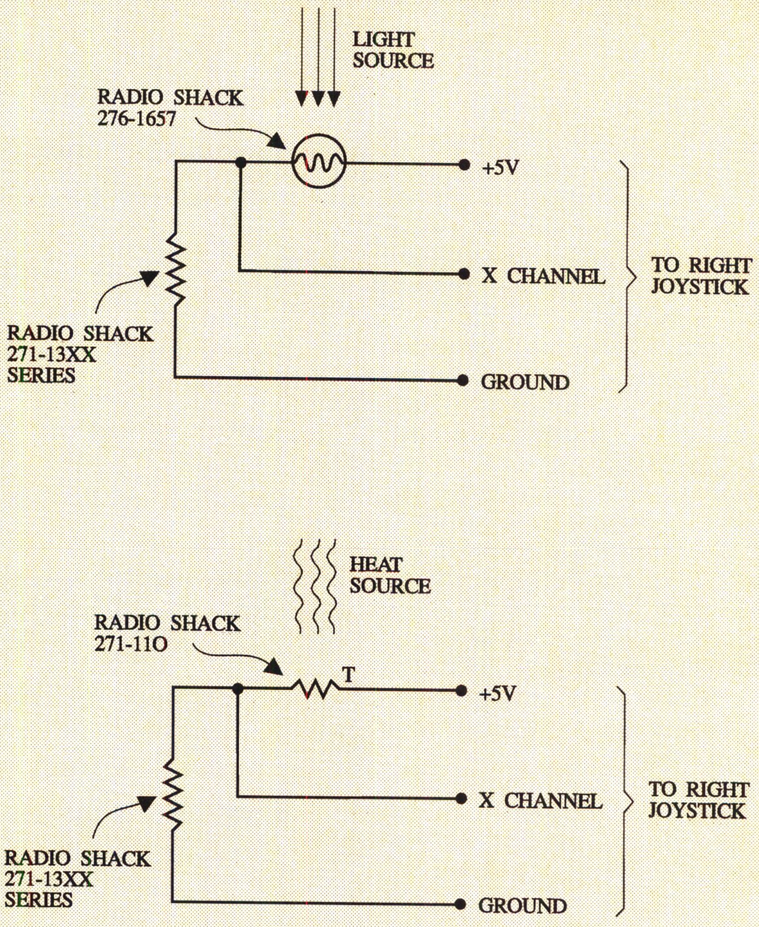


Figure 4. Connections for Examples

Editor's Note: The assembly language source code is provided here for reference only and will not appear on RAINBOW ON TAPE *or* RAINBOW ON DISK.

Listing 1:

```
                     ***********************************************************
                    * JOYSTICK INPUT A TO D ROUTINE FOR RIGHT JOYSTICK - *
                    * BOTH X AND Y. STORES INPUT VALUES IN BUFFER. TIME  *
                    * DELAY BETWEEN SAMPLES VARIABLE. POS'N INDEPENDENT. *
                    *                                                    *
                    * LOCATION    X     Y    BOTH                        *
                    *  ENTRY    6000  607A   6000                        *
                    *  6076       95   -      0A                        *
                    *  60F0       -    95     87                        *
                    *                                                    *
                    * LOCATIONS 606B,C AND 60E5,6 CHANGE BASED UPON TIME *
                    * REPRESENTATION OF SCOPE.                           *
                    *                                                    *
                    * LOCATIONS 6073,4 AND 60ED,E CHANGE BASED ON TIME   *
                    * AS WELL.                                           *
                     ***********************************************************
                    *                                                    *
      6100          BUFFER EQU     $6100     START OF BUFFER
      7FFF          BUFEND EQU     $7FFF     END OF BUFFER
6000 108E FF00 START  LDY      #$0FF00   LOAD INPUT PIA ADDRESS
```

```
6004 8E    6100         LDX      #BUFFER   LOAD BUFFER PNTR ADDRESS
6007 C6    00    INP000 LDB      #0        SELECT RIGHT.X
6009 BD    A9A2         JSR      $A9A2     SELECT SUBROUTINE
                 ******************************************************
600C C6    80    INP005 LDB      #$80      LOAD START VALUE
600E F7    FF20         STB      $0FF20    OUTPUT FIRST VALUE
6011 A6    A4           LDA      ,Y        INPUT COMPARATOR
6013 2B    04           BMI      INP015    GO IF TOO LOW
6015 C0    40           SUBB     #$40      SUBTRACT DELTA
6017 20    04           BRA      INP020    GO TO SECOND ITERATION
6019 CB    40    INP015 ADDB     #$40      ADD DELTA
601B 20    00           BRA      INP020    GO TO SECOND ITERATION
601E F7    FF20  INP020 STB      $0FF20    OUTPUT SECOND VALUE
6020 A6    A4           LDA      ,Y        INPUT COMPARATOR
6022 2B    04           BMI      INP025    GO IF TOO LOW
6024 C0    20           SUBB     #$20      SUBTRACT DELTA
6026 20    04           BRA      INP030    GO TO SECOND ITERATION
6028 CB    20    INP025 ADDB     #$20      ADD DELTA
602A 20    00           BRA      INP030    GO TO SECOND ITERATION
602C F7    FF20  INP030 STB      $0FF20    OUTPUT THIRD VALUE
602F A6    A4           LDA      ,Y        INPUT COMPARATOR
6031 2B    04           BMI      INP035    GO IF TOO LOW
6033 C0    10           SUBB     #$10      SUBTRACT DELTA
6035 20    04           BRA      INP040    GO TO SECOND ITERATION
6037 CB    10    INP035 ADDB     #$10      ADD DELTA
6039 20    00           BRA      INP020    GO TO SECOND ITERATION
603B F7    FF20  INP040 STB      $0FF20    OUTPUT FOURTH VALUE
603E A6    A4           LDA      ,Y        INPUT COMPARATOR
6040 2B    04           BMI      INP045    GO IF TOO LOW
6042 C0    08           SUBB     #$8       SUBTRACT DELTA
6044 20    04           BRA      INP050    GO TO SECOND ITERATION
6046 CB    08    INP045 ADDB     #$8       ADD DELTA
6048 20    00           BRA      INP050    GO TO SECOND ITERATION
604A F7    FF20  INP050 STB      $0FF20    OUTPUT FIFTH VALUE
604D A6    A4           LDA      ,Y        INPUT COMPARATOR
604F 2B    04           BMI      INP055    GO IF TOO LOW
6051 C0    04           SUBB     #$4       SUBTRACT DELTA
6053 20    04           BRA      INP060    GO TO SECOND ITERATION
6055 CB    04    INP055 ADDB     #$4       ADD DELTA
6057 20    00           BRA      INP060    GO TO SECOND ITERATION
```

microseconds (130 millionths of a second). With a little extra overhead added, a joystick input can be read in about 167 microseconds, making the number of samples per second about 6000. If both the X and Y inputs are sampled, this rate falls to half: about 3000 samples per second.

To read the X input, only the first half of the subroutine is executed. To read the Y input, only the second half of the subroutine is executed. To read both inputs for a dual-trace display, both the first and second halves of the subroutine are executed. The calling BASIC program changes the machine language code to make the proper transitions from one half to the next.

Each half reads an input and then delays a set amount of time before the next input is read. This allows a sampling rate ranging from 6000 samples per second to one sample every 1.66 seconds.

If a sample were read and then displayed on the screen, the software overhead associated with updating the screen would reduce the sampling rate to about 30 samples per second. For this reason, samples are stored in a sampling buffer. The buffer in this case is just a large area of memory set aside for data. The size of the buffer is 600 bytes for sampling rates of six samples per

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second or fewer. The size of the buffer is about 8000 bytes for sample rates of greater than six samples per second. Only the first 600 bytes are displayed in the latter case, however. You may want to change the BASIC code to display all 8000 values.

Since only the first portion of the sampled data is displayed, you must act quickly to sample the proper data or present the CoCo with a continuous signal. Sampling at a particular point when the input changes to a certain limit voltage or in other ways is known as triggering. It can be put into the BASIC code by scanning for certain sample values and then displaying the data from that point. (This function is not present in this version of *Scope*, however.)

The BASIC Driver

The BASIC code for the *Scope* program is shown in Listing 2. Most of it is the driver for the assembly language code. It handles all tasks connected with setting up parameters for the acquisition of data values and screen formatting and then calls the assembly language code.

The first thing the BASIC code does is load the machine language representation of the assembly language code. People get confused about assembly language versus machine language. The program shown in Listing 1 is an English-like symbolic representation of the 6809 instructions — the assembly language code. After analysis and assembling by the assembler program, the machine code representation of this assembly language is produced. The machine code is shown on the left side of Listing 1 in hexadecimal, a handy way to represent ones and zeroes — CB is much more compact than 11001011.

The machine code is also present in the five data statements in the BASIC program. A short loop reads the data values, prefixes each with an `&H` (to flag the BASIC interpreter that the data is in hexadecimal), and then stores the machine code value into locations in high memory from `&H6000` through `&H60F1`. The area from `&H6000` is protected by a `CLEAR 1000,&H5FFF` statement at the beginning of the program. These statements keep BASIC from overwriting the machine code values by storage of variables or stack use. Once the values are stored, they need not be stored again.

The BASIC program is divided into six subroutines:

```
6059 F7    FF20 INP060 STB    $0FF20    OUTPUT SIXTH VALUE
605C A6    A4          LDA    ,Y        INPUT COMPARATOR
605E 2B    04          BMI    INP065    GO IF TOO LOW
6060 C0    02          SUBB   #$2       SUBTRACT DELTA
6062 20    04          BRA    INP070    GO TO SECOND ITERATION
6064 CB    02   INP065 ADDB   #$2       ADD DELTA
6066 20    00          BRA    INP070    GO TO SECOND ITERATION
6068 E7    80   INP070 STB    ,X+       STORE VALUE
                ********************************************************
606A CC    0000        LDD    #$0000    LOAD DELAY FACTOR ***CHNGS***
606D 83    0001 INPDEC SUBD   #1        DECREMENT
6070 26    FB          BNE    INPDEC    LOOP FOR DELAY
6072 8C    7FFF        CMPX   #BUFEND   TEST FOR END OF BUFFER
6075 26    XX          BNE    INP005    GO IF NOT END ***CHANGES***
6077 39                RTS              END
                ********************************************************
6078 20    8D   LINK   BRA    INP000    LINK FOR RELOCATABILITY
                ********************************************************
607A 108E FF00 YSTRT   LDY    #$0FF00   LOAD INPUT PIA ADDRESS
607E 8E    6100        LDX    #BUFFER   LOAD BUFFER PNTR ADDRESS
6081 C6    01          LDB    #1        SELECT RIGHT,Y
6083 BD    A9A2        JSR    $A902     SELECT SUBROUTINE
                ********************************************************
6086 C6    80   INP105 LDB    #80       LOAD START VALUE
6088 F7    FF20        STB    $0FF20    OUTPUT FIRST VALUE
608B A6    A4          LDA    ,Y        INPUT COMPARATOR
608D 2B    04          BMI    INP115    GO IF TOO LOW
608F C0    40          SUBB   #$40      SUBTRACT DELTA
6091 20    04          BRA    INP120    GO TO SECOND ITERATION
6093 CB    40   INP115 ADDB   #$40      ADD DELTA
6095 20    00          BRA    INP120    GO TO SECOND ITERATION
6097 F7    FF20 INP120 STB    $0FF20    OUTPUT SECOND VALUE
609A A6    A4          LDA    ,Y        INPUT COMPARATOR
609C 2B    04          BMI    INP125    GO IF TOO LOW
609E C0    20          SUBB   #$20      SUBTRACT DELTA
60A0 20    04          BRA    INP130    GO TO SECOND ITERATION
60A2 CB    20   INP125 ADDB   #$20      ADD DELTA
60A4 20    00          BRA    INP130    GO TO SECOND ITERATION
60A6 F7    FF20 INP130 STB    $0FF20    OUTPUT THIRD VALUE
60A9 A6    A4          LDA    ,Y        INPUT COMPARATOR
60AB 2B    04          BMI    INP135    GO IF TOO LOW
60AD C0    10          SUBB   #$10      SUBTRACT DELTA
60AF 20    04          BRA    INP140    GO TO SECOND ITERATION
60B1 CB    10   INP135 ADDB   #$10      ADD DELTA
60B3 20    00          BRA    INP120    GO TO SECOND ITERATION
60B5 F7    FF20 INP140 STB    $0FF20    OUTPUT FOURTH VALUE
60B8 A6    A4          LDA    ,Y        INPUT COMPARATOR
60BA 2B    04          BMI    INP145    GO IF TOO LOW
60BC C0    08          SUBB   #$8       SUBTRACT DELTA
60BE 20    04          BRA    INP150    GO TO SECOND ITERATION
60C0 CB    08   INP145 ADDB   #$8       ADD DELTA
60C2 20    00          BRA    INP150    GO TO SECOND ITERATION
60C4 F7    FF20 INP150 STB    $0FF20    OUTPUT FIFTH VALUE
60C7 A6    A4          LDA    ,Y        INPUT COMPARATOR
60C9 2B    04          BMI    INP155    GO IF TOO LOW
60CB C0    04          SUBB   #$4       SUBTRACT DELTA
60CD 20    04          BRA    INP160    GO TO SECOND ITERATION
60CF CB    04   INP155 ADDB   #$4       ADD DELTA
60D1 20    00          BRA    INP160    GO TO SECOND ITERATION
60D3 F7    FF20 INP160 STB    $0FF20    OUTPUT SIXTH VALUE
60D6 A6    A4          LDA    ,Y        INPUT COMPARATOR
60D8 2B    04          BMI    INP165    GO IF TOO LOW
60DA C0    02          SUBB   #$2       SUBTRACT DELTA
60DC 20    04          BRA    INP170    GO TO SECOND ITERATION
60DE CB    02   INP165 ADDB   #$2       ADD DELTA
60E0 20    00          BRA    INP170    GO TO SECOND ITERATION
60E2 E7    80   INP170 STB    ,X+       STORE VALUE
             ********************************************************
60E4 CC    0000        LDD    #$0000    LOAD DELAY FACTOR ***CHNGS***
60E7 83    0001 INPDED SUBD   #1        DECREMENT
60EA 26    FB          BNE    INPDED    LOOP FOR DELAY
60EC 8C    7FFF        CMPX   #BUFEND   TEST END ***CHANGES***
60EF 26    XX          BNE    INP005    GO IF NOT END ***CHANGES***
60F1 39                RTS              END
             ********************************************************
```

- Initialize — This subroutine sets some of the program parameters to default values and calls other subroutines for the screen display. It also sets up three `GET` buffers with cleared screen data. The High-Res four-color screen (640 by 192 elements in four colors) is used for *Scope*. One of the unfortunate problems with CoCo 3 BASIC is that an `HPRINT` statement cannot clear the screen with spaces. The `HBUFF` statements allocate `GET` buffers that can be used to clear small segments of the screen prior to displaying messages.
- Display Graticule — A graticule is a clear overlay of ruled lines found on a scope. Here the graticule is made by `HLINE` statements. The subroutine creates a window on

Table 1: Horizontal Scales for *Scope*

10, 20, 30, 40, 50, 60, 70, 80, 90 milliseconds/division
100, 200, 300, 400, 500, 600, 700, 800, 900 ms/division
1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000 ms/division
10000, 20000, 30000, 40000, 50000, 60000, 70000, 80000,
90000, 100000 ms/division

the screen that is the area in which sampled data points are plotted.

- Read Keys — This subroutine is the heart of the BASIC code. It allows the user to change the parameters for the sampling and starts the sampling process by calling the machine language code. More on this suboutine below.
- Display Information Line — This subroutine displays two lines at the bottom of the screen to show current parameters.
- Display Select Line — This subroutine displays the select line at the top of the screen that indicates what current parameter has been selected.
- Plot Scope Display — This subroutine plots the first 600 data values that have been sampled. Data values are displayed across the screen from left to right. The width of the display area is exactly 600, so the X values for the display are 20 through 620. The Y values depend upon the data read during sampling and the vertical scale used. Vertical scales of .2, .4, .6, .8 and 1 volt per division can be used. There are five divisions and input values from 0 through 5 volts that can be represented by using the 1 volt per division scale. For other scales, *Scope* attempts to store the point but will report a point that is off the screen by a Points Off Screen! message.

Single traces (X or Y) or dual traces are handled separately. Single traces are displayed from the first 600 physical values in the data buffer. Dual traces are displayed from the first 1200 physical values in the buffer — X and Y data alternates.

With 600 points across the screen, it is sometimes difficult to connect the dots to see the curve represented. For this reason, points are drawn as lines rather than individual dots. This makes for a much more understandable display.

Read Keys Subroutine

The heart of the BASIC code is the Read Keys subroutine. This subroutine reads and stores data in six variables. PS is the *Parameter Selected* variable and indicates which of the six parameters — Trace1 Y, Trace1 X, Trace2 Y, Trace2 X, Refresh or Display Mode — is currently selected. Pressing the right and left arrows changes the currently selected parameter.

Once the parameter is selected, it can be changed to the desired value by pressing

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the up arrow key. With each key press, a new value for the parameter is displayed on the screen. Variables `P0` through `P5` hold the current value for each parameter.

Pressing G starts the acquisition of the samples. First, certain address links are changed in the machine language code based upon whether the sample is of X, Y or both channels. Next, the time delay variable `TD` is computed, based upon the horizontal sweep time. Finally, the machine language subroutine is called. There are two entry points to the machine language code depending again upon whether X, Y or both channels are involved. The machine language code acquires the data and then returns to the BASIC program. On the return, the Plot Scope Display subroutine is called to display the data. After the display, another sample can be taken or the parameters can be redefined.

Pressing the W key allows you to save the current acquisition buffer as a disk file. *Scope* highlights the filename area on the bottom screen line. You can then enter a filename for the data. Only the first 600 points are saved (or the first 1200 for dual trace). Press ENTER alone to abort the save.

Pressing R allows you to read in a previously written data file. The file will read in, the parameters will be set to those of the file, and the data will be displayed in the plot window.

Running *Scope*

Load the BASIC program and enter `RUN`. The machine language code is contained within *Scope* and is relocated to high memory. The program first draws the graticule display and then displays the two information lines and the select line. Press the right or left arrow keys to select one of the six functions to change. As each function is selected, press the up arrow key to select the proper value.

Changing the Vertical Scale

The scope display has five major vertical divisions. The bottom line of the display always represents a 0 volt level (ground). At the highest vertical scale, each division represents one volt, making the top line equal to +5 volts, DC. The top line equals +4 volts, +3 volts, +2 volts and +1 volts for .8, .6, .4 and .2 volts per division, respectively. With all scales but 1 volt per division, the points may be out of the display if the voltage is high enough. If this occurs, the Points Off Screen! message is displayed and the plot continues.

When X data is accumulated, it is displayed based upon the `TRACE1, Y= XXXX V/DIV` value. When Y data is accumulated, it is displayed based upon the `TRACE2, Y= XXXX V/DIV` value. When a dual trace is displayed, it is based upon the `TRACE1, Y= XXXXV/DIV` value — the `TRACE2` value has no effect.

Changing the Horizontal Scale

The horizontal scales shown in Table 1 may be set for either `TRACE1` (X channel) or `TRACE2` (Y channel).

There are 10 divisions horizontally. Multiply the time per division by 10 to get the time for the total horizontal distance. At 10 milliseconds per division, for example, the horizontal scale represents 10 times 10 = 100 milliseconds. At 100000 ms/division, the horizontal scale represents 10 times 100000 = 1,000,000 milliseconds or 1000 seconds (16.66 minutes).

There are 60 points per division. At 10 milliseconds per division, each dot represents 10/60 milliseconds or .167 milliseconds (167 microseconds). This is the finest resolution of which *Scope* is capable.

Again, as in the vertical scale case, `TRACE1` is controlled by the `TRACE1, X= XXXX MS/DIV` value, `TRACE2` is controlled by the `TRACE2, X= XXXX MS/DIV` value, and a dual trace display is controlled by the `TRACE1, X= XXXX MS/DIV` value.

Dual-trace operation will not work at 10 ms/division due to the minimum time required for sampling. If 10 ms/division is selected and the display mode is set to `X AND Y`, the time is changed to 20 ms/division and no sampling takes place.

Changing the Refresh Parameter

Scope beeps at the start and end of data acquisition. If the Continuous Refresh mode is set, *Scope* continues with a new sample after the old is displayed. Press the S key to stop the cycling. If the Step Refresh mode is set, press any key but S to step to the next data acquisition. Press S to stop the cycling.

Changing the Display Mode

`X ONLY`, `Y ONLY` and `X AND Y` may be set by changing the Display Mode parameter.

Interrupting the Sampling

Once started by a G keypress, the sampling cannot be ended until the buffer is full. Press S to stop the sampling before the next cycle.

Data Files

Data files can be written by a W and read by an R keypress. If you want to write a file after acquisition, make certain you press the S key to stop the program if you are in the Continuous Refresh mode. You must press S even in Step mode to bring the program back to the command interpreter.

Accuracy

Since the maximum range of input values is 64, the vertical display has an accuracy of about two percent. The horizontal display is accurate to about one percent for longer times and about four percent for very short times.

The CoCo in Biochemical Research

Since running these columns on interfacing, I've gotten many letters that indicate there's a lot of interest in using the CoCo for real-world measurements. One sample is from Lucien Delcourt, Ph.D., of Laval, Quebec, who is engaged in biochemical research. "Thanks to your interesting articles, I have been able to make temperature measurements. I have employed a thermistor (Western Electric) to do so. It was calibrated against a precision thermometer. The readings were inserted in a program to make samplings at different periods. The results were then routed to the printer." The CoCo can perform some very useful functions in the real world.

See you next month with more CoCo topics. ☐

CoCo 3

190	100
290	127
360	13
390	221
480	46
620	192
770	149
880	217
950	131
1040	246
1100	71
1140	93
1195	131
1253	56
1262	227
1279	127
1330	102
1400	131
1490	162
1590	116
1611	245
END	126

Listing 2: `SCOPE`

```
100 ' COCO 3 OSCILLOSCOPE PROGRA
M. EMULATES A DUAL-TRACE SCOPE.
110 '
120 ' DATA DICTIONARY:
130 ' A$=TEMPORARY VARIABLE
```

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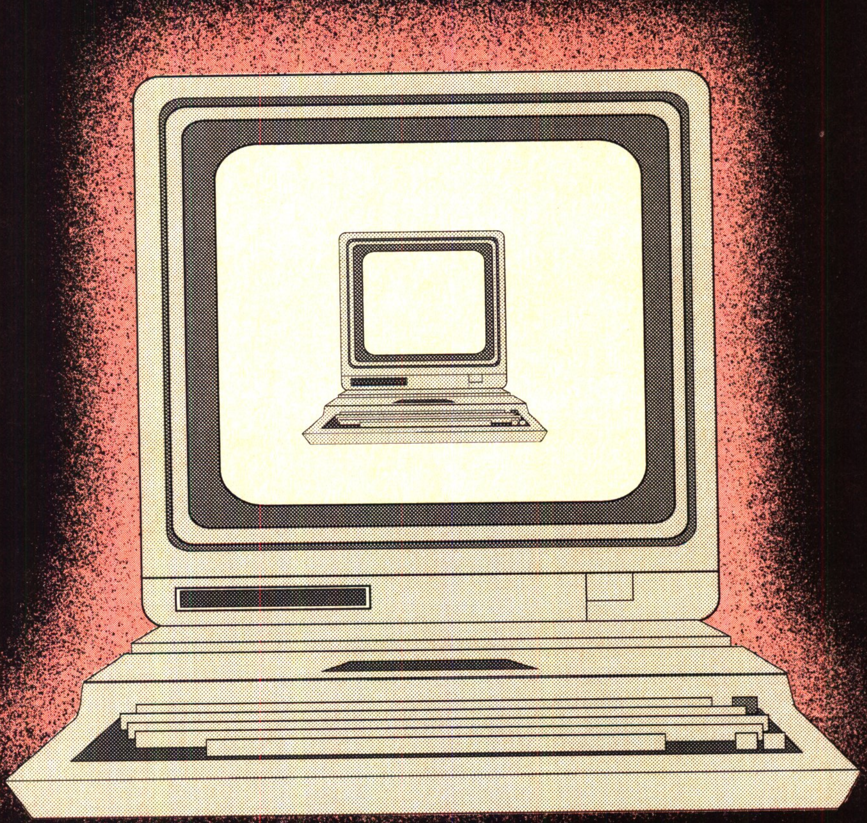
CoCo: An Affectionate History is scheduled for release early in the fall of 1990. Prior to publication it will be available in an attractive limited-edition hardcover version for only $45. A softcover version will also be available for $15.95. But if you order now, you can reserve copies of the softcover version for a pre-publication price of just $13.50 apiece. Reserve a copy of *CoCo: An Affectionate History* for yourself. Or order several for those you care about — and take a walk down Memory Lane together.



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```
135 ' B$=TEMPORARY VARIABLE
140 ' EB=END OF BUFFER
145 ' FI$=FILE NAME VARIABLE
150 ' I=TEMPORARY INDEX VARIABLE
160 ' P0=Y VOLTS PER DIVISION FO
R TRACE 1
170 ' P1=X TIME PER DIVISION FOR
 TRACE 1 IN MS
180 ' P2=Y VOLTS PER DIVISION FO
R TRACE 2
190 ' P3=X TIME PER DIVISION FOR
 TRACE 2 IN MS
200 ' P4=REFRESH, 0=CONTINUOUS,
1=STEP
210 ' P5=DISPLAY MODE, 0=X, 1=Y,
 2=X AND Y
220 ' PS=PARAMETER SELECTED, 0-5
230 ' PS$=TEMPORARY STRING VARIA
BLE
240 ' SB=START OF BUFFER
250 ' SF=Y SCALE FACTOR, FINAL
260 ' Y=TEMPORARY VARIABLE FOR Y
 POSITION
270 ' YS=Y SCALE FACTOR
280 '
290 ' STORE MACHINE LANGUAGE COD
E IN &H6000 ON
300 DEFUSR0=&H6000: DEFUSR1=&H60
7A
310 CLEAR 1000, &H5FFF
320 FOR I=&H6000 TO &H60F1
330 READ A$: POKE I,VAL("&H"+A$)
340 NEXT
350 DATA 10,8E,FF,00,8E,61,00,C6
,00,BD,A9,A2,C6,80,F7,FF,20,A6,A
4,2B,04,C0,40,20,04,CB,40,20,00,
F7,FF,20,A6,A4,2B,04,C0,20,20,04
,CB,20,20,00,F7,FF,20,A6,A4,2B
360 DATA 04,C0,10,20,04,CB,10,20
,00,F7,FF,20,A6,A4,2B,04,C0,08,2
0,04,CB,08,20,00,F7,FF,20,A6,A4,
2B,04,C0,04,20,04,CB,04,20,00,F7
,FF,20,A6,A4,2B,04,C0,02,20,04
370 DATA CB,02,20,00,E7,80,CC,00
,00,83,00,01,26,FB,8C,7F,FF,26,0
0,39,20,8D,10,8E,FF,00,8E,61,00,
C6,01,BD,A9,A2,C6,80,F7,FF,20,A6
,A4,2B,04,C0,40,20,04,CB,40,20
380 DATA 00,F7,FF,20,A6,A4,2B,04
,C0,20,20,04,CB,20,20,00,F7,FF,2
0,A6,A4,2B,04,C0,10,20,04,CB,10,
20,00,F7,FF,20,A6,A4,2B,04,C0,08
,20,04,CB,08,20,00,F7,FF,20,A6
390 DATA A4,2B,04,C0,04,20,04,CB
,04,20,00,F7,FF,20,A6,A4,2B,04,C
0,02,20,04,CB,02,20,00,E7,80,CC,
00,00,83,00,01,26,FB,8C,7F,FF,26
,00,39
400 '
410 ' INITIALIZE
420 HSCREEN 4
430 HCLS
440 HBUFF 1,3200
450 HBUFF 2,200
460 HBUFF 3,200
465 HBUFF 4,300
470 HGET (0,174)-(639,191),1
480 HGET (0,0)-(47,9),2
490 HGET (0,0)-(79,7),3
495 HGET (0,0)-(119,7),4
500 PS=0
510 P1=10: P3=10
520 P0=1: P2=1
530 P4=0: P5=0
540 GOSUB 620
550 GOSUB 1280
560 GOSUB 1430
570 GOSUB 760
580 GOSUB 1270
590 GOSUB 1420
600 '
610 ' DISPLAY GRATICULE SUBROUTI
NE
620 FOR X=20 TO 620 STEP 60
630 HLINE (X,21)-(X,171),PSET
640 NEXT
650 FOR Y=21 TO 171 STEP 30
660 HLINE (20,Y)-(620,Y),PSET
670 NEXT
680 FOR X=20 TO 620 STEP 12
690 HLINE (X,169)-(X,173),PSET
700 NEXT
710 FOR Y=21 TO 171 STEP 4
720 HLINE (316,Y)-(324,Y),PSET
730 NEXT
740 RETURN
750 '
760 ' READ KEYS SUBROUTINE
770 A$=INKEY$: IF A$="" THEN GOT
O 770
780 IF A$<>CHR$(9) THEN GOTO 810
790 PS=PS+1: IF PS=6 THEN PS=0
800 GOSUB 1420: GOTO 770
810 IF A$<>CHR$(8) THEN GOTO 840
820 PS=PS-1: IF PS=-1 THEN PS=5
830 GOSUB 1420: GOTO 770
840 IF A$<>CHR$(94) THEN GOTO 10
70
850 IF PS<>0 THEN GOTO 880
860 P0=P0+.2: IF P0=1.2 THEN P0=
.2
870 HPUT (104,176)-(123,183),2:
HPRINT (12,22),P0: GOTO 770
880 IF PS<>1 THEN GOTO 910
890 IF P1<100 THEN P1=P1+10 ELSE
 IF P1<1000 THEN P1=P1+100 ELSE
IF P1<10000 THEN P1=P1+1000 ELSE
 P1=P1+10000: IF P1=110000 THEN
P1=10
900 HPUT (200,176)-(247,183),2:H
PRINT (24,22),P1: GOTO 770
910 IF PS<>2 THEN GOTO 940
920 P2=P2+.2: IF P2=1.2 THEN P2=
.2
930 HPUT (424,176)-(443,183),2:
HPRINT (52,22),P2: GOTO 770
940 IF PS<>3 THEN GOTO 970
950 IF P3<100 THEN P3=P3+10 ELSE
 IF P3<1000 THEN P3=P3+100 ELSE
IF P3<10000 THEN P3=P3+1000 ELSE
 P3=P3+10000: IF P3=110000 THEN
P3=10
960 HPUT (520,176)-(567,183),2:H
PRINT (64,22),P3: GOTO 770
970 IF PS<>4 THEN GOTO 1010
980 IF P4=0 THEN P4=1 ELSE P4=0
990 HPUT (80,184)-(159,192),3
1000 IF P4=0 THEN HPRINT (10,23)
, "CONTINUOUS" ELSE HPRINT (10,2
3), "STEP"
1010 IF PS<>5 THEN GOTO 1050
1020 P5=P5+1: IF P5=3 THEN P5=0
1030 HPUT (280,184)-(359,192),3
1040 IF P5=0 THEN HPRINT (35,23)
,"X ONLY" ELSE IF P5=1 THEN HPRI
NT (35,23),"Y ONLY" ELSE HPRINT
(35,23), "X AND Y"
1050 GOTO 770
1060 ' G=GOTO ACCUMULATE DATA
1070 IF A$<>"G" THEN GOTO 1251
1080 IF P5=0 THEN POKE &H6076,&H
95 ELSE IF P5=1 THEN POKE &H60F0
,&H95 ELSE POKE &H6076,&H0A: POK
E &H60F0,&H87
1090 IF P5=0 THEN IF P1>=1000 TH
EN POKE &H6073,&H63: POKE &H6074
,&H58
1100 IF P5=0 THEN IF P1<1000 THE
N POKE &H6073,&H80: POKE &H6074,
&H00
1110 IF P5=1 THEN IF P3>=1000 TH
EN POKE &H60ED,&H63: POKE &H60EE
,&H58
1120 IF P5=1 THEN IF P3<1000 THE
N POKE &H60ED,&H80: POKE &H60EE,
&H00
1130 IF P5=2 THEN IF P1>=1000 TH
EN POKE &H6073,&H65: POKE &H6074
,&HB0: POKE &H60ED,&H65: POKE &H
60EE,&HB0
1140 IF P5=2 THEN IF P1<1000 THE
N POKE &H6073,&H80: POKE &H6074,
&H00: POKE &H60ED,&H80: POKE &H6
0EE,&H00
1150 IF P5=0 THEN TD=P1 ELSE IF
P5=1 THEN TD=P3 ELSE TD=P1
1160 TD=((TD/60)-.130)/.008: IF
P5=2 THEN TD=TD/2
1170 MS=INT(TD/256)
1180 LS=INT(TD-MS*256)
1190 POKE &H606B,MS: POKE &H606C
,LS: POKE &H60E5,MS: POKE &H60E6
,LS
1191 IF P5=2 AND P1=10 THEN P1=2
0: GOSUB 1280: GOTO 770
1195 SOUND 128,1
1200 IF P5=0 THEN A=USR0(0) ELSE
 IF P5=1 THEN A=USR1(0) ELSE IF
P5=2 THEN A=USR0(0)
1205 SOUND 128,1
1210 GOSUB 1490
1220 IF P4=0 THEN IF INKEY$="" T
HEN GOTO 1191 ELSE GOTO 770
1230 IF P4<>1 THEN GOTO 1250
1240 A$=INKEY$: IF A$="" THEN GO
TO 1240 ELSE IF A$="S" THEN GOTO
 770 ELSE GOTO 1191
1250 GOTO 770
1251 IF A$<>"W" THEN GOTO 1260
1252 HPUT (416,184)-(535,192),4,
PRESET
1253 LINE INPUT FI$: IF FI$="" T
HEN GOTO 1258 ELSE HPRINT (52,23
), FI$
1254 OPEN "O", #1, FI$
1255 PRINT#1,PS,P0,P1,P2,P3,P4,P
5
1256 FOR I=&H6100 TO &H65AF: B=(
INT(PEEK(I)/4)+64): PRINT#1,CHR$
(B): NEXT
1257 CLOSE 1
1258 HPUT (416,184)-(535,192),4
1259 GOTO 770
1260 IF A$<>"R" THEN GOTO 770
1261 HPUT (416,184)-(535,192),4,
PRESET
1262 LINE INPUT FI$: IF FI$="" T
HEN GOTO 1267 ELSE HPRINT (52,23
),FI$
1263 OPEN "I", #1, FI$
1264 INPUT#1,PS,P0,P1,P2,P3,P4,P
5
1265 FOR I=&H6100 TO &H65AF: INP
UT#1, B$: B=(ASC(B$)-64)*4: POKE
 I,B: NEXT
1266 CLOSE 1
1267 HPUT (416,184)-(535,192),4
1268 GOSUB 1430: GOSUB 1500: GOT
O 770
1278 '
1279 ' DISPLAY INFORMATION LINE
SUBROUTINE
1280 HPUT (0,174)-(639,191),1
1290 HPRINT (0,22), "  TRACE 1:
Y=   V/DIV  X=        MS/DIV    T
RACE 2: Y=   V/DIV  X=         MS/
DIV"
1300 HPRINT (0,23), "  REFRESH:
          DISPLAY MODE:
   FILE: "
1310 HPRINT (0,1), "  CURRENT PA
RAMETER SELECTED:"
1320 HPUT (104,176)-(123,183),2:
 HPRINT (12,22),P0
1330 HPUT (200,176)-(247,183),2:
HPRINT (24,22),P1
1340 HPUT (424,176)-(443,183),2:
 HPRINT (52,22),P2
1350 HPUT (520,176)-(567,183),2:
 HPRINT (64,22),P3
1360 HPUT (80,184)-(159,192),3
1370 IF P4=0 THEN HPRINT (10,23)
,"CONTINUOUS" ELSE HPRINT (10,23
), "STEP"
1380 HPUT (280,184)-(359,192),3
1390 IF P5=0 THEN HPRINT (35,23)
,"X ONLY" ELSE IF P5=1 THEN HPRI
NT (35,23),"Y ONLY" ELSE HPRINT
(35,23),"X AND Y"
1400 RETURN
1410 '
1420 ' DISPLAY SELECT LINE SUBRO
UTINE
1430 HPUT (232,0)-(639,17),1
1440 IF PS=0 THEN PS$="TRACE 1,
Y" ELSE IF PS=1 THEN PS$="TRACE
1, X" ELSE IF PS=2 THEN PS$="TRA
CE 2,Y" ELSE IF PS=3 THEN PS$="T
RACE 2,X" ELSE IF PS=4 THEN PS$=
"REFRESH"
1450 IF PS=5 THEN PS$="DISPLAY M
ODE"
1460 HPRINT (30,1), PS$
1470 RETURN
1480 '
1490 ' PLOT SCOPE DISPLAY
1500 FOR Y=16 TO 156 STEP 14: HP
UT (0,Y)-(639,Y+17),1: NEXT
1510 GOSUB 620: GOSUB 1280
1520 SB=&H6100
1530 IF P5=0 OR P5=1 THEN EB=&H6
357 ELSE EB=&H65AF
1540 IF P5=0 OR P5=2 THEN YS=1/P
0 ELSE YS=1/P2
1550 SF=(150/252)*YS
1560 HCOLOR 2,0
1570 IF P5<>2 THEN GOTO 1640
1580 FOR I=SB TO EB STEP 2: Y=17
0-(PEEK(I) AND &HFC)*SF: X=(I-&H
6100)/2
1590 IF X=0 THEN IF Y>19 THEN HL
INE(X+20,Y)-(X+20,Y),PSET: NEXT
1600 IF Y>=20 THEN HLINE -(X+20,
Y),PSET:NEXT ELSE HPRINT (50,3),
"POINTS OFF SCREEN!":NEXT
1605 HCOLOR 3,0
1610 FOR I=SB+1 TO EB STEP 2: Y=
170-(PEEK(I) AND &HFC)*SF: X=(I-
&H6100)/2
1611 IF X<1 THEN IF Y>19 THEN HL
INE(X+20,Y)-(X+20,Y),PSET: NEXT
1620 IF Y>=20 THEN HLINE -(X+20,
Y),PSET:NEXT ELSE HPRINT (50,3),
"POINTS OFF SCREEN!":NEXT
1630 GOTO 1670
1640 FOR I=SB TO EB: Y=170-(PEEK
(I) AND &HFC)*SF: X=I-&H6100
1650 IF X=0 THEN IF Y>19 THEN HL
INE(X+20,Y)-(X+20,Y),PSET: NEXT
1660 IF Y>=20 THEN HLINE -(X+20,
Y),PSET:NEXT ELSE HPRINT (50,3),
"POINTS OFF SCREEN!":NEXT
1670 HCOLOR 1,0
1680 RETURN
```

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52,510 Chris Kremo, Bethel, CT
12,950 Paul DeVita, Vallejo, CA

ONE-ON-ONE *(Radio Shack)*
1,310-0 Jon Breckel, Wilmington, OH
1,302-0 Thomas Payton, Anderson, SC
1,280-0 Randy Sunderland, Page, WV
1,276-0 Jonathan Dorris, Indianapolis, IN
1,260-0 Brandon Reece, Chickamauga, GA

OUTHOUSE *(MichTron)*
534,060 Kay Foxe, Kansas City, MO
59,641 Sam Zehel, Coal Center, PA
38,640 Dave Staub, Moundsville, WV

PAPER ROUTE *(Diecom Products)*
248,400 Cathy E. Kimble, Glendale, AZ
150,560 Heather Hamblen, Bar Harbor, ME

PITFALL II *(Activision)*
1,568,500 Sandy Baker, Martin City, Montana
1,519,500 Jim Hammons, Martin City, Montana
1,085,500 Tracey Lee Slack, Atwood, Ontario
871,500 Aaron Florence, English, IN
586,500 Jonathan Toloski, Torrington, CT

POOYAN *(Datasoft)*
1,453,950 Lois Crowson, East Alton, IL
1,286,050 Craig Schneider, North Platte, NB
626,700 Charles Rene de Cotret, Saint-Laurent, Quebec

POPCORN *(Radio Shack)*
150,560 Tom Cherubino, Brooklyn, NY
105,560 Heather Condit, Grafton, ND
26,889 Claude Jalbert, Matane, Quebec
25,450 Dianne Mozzetti, Pittsburgh, PA

PROSPECTOR (THE RAINBOW, 12/88)
57,300 Andy DeGroat, Saginaw, MI
56,150 Sara Mittelstaedt, Kiel, WI
51,850 Joel Klein, Indianapolis, IN
27,650 Ryun Schlecht, Gackle, ND
15,150 Cray Augsburg
5,000 Chris Nuwer, Lockport, NY
4,100 Angie Mittelstaedt, Kiel, WI
4,050 Jutta Kapfhammer

PYRAMID 2000 *(Radio Shack)*
220 Matt Chlapowski, Webster, MA
220 Darren King, Yorkton, Saskatchewan
220 Mike Snyder, Allen, OK

PYRAMIX *(Color Venture)*
72,060 Teresa Grant, Groton, CT
68,550 Andy Freeman, Turtle Lake, WI
67,850 Richard Winkelbauer, Bronx, NY
37,950 Blain Jamieson, Kingston, Ontario

QUIX *(Tom Mix)*
8,407,772 John Haldane, Tempe, AZ

RAD WARRIOR *(Epyx)*
21,424 Robert Mefferd, Rockford, OH
10,064 Kreig Daniel Bryson, Woodstock, GA
8,736 Jonathan Fullerton, Gardiner, ME
6,016 Diedrick Brown, Pine Mountain, GA
4,368 Sean Russell, Saint John, New Brunswick
4,224 Josh Encarnation, Omaha, NE
4,112 Randy Stocksdale, Racine, WI
3,936 Matthew Smith, Courtenay, British Columbia

RADIO BALL *(Radio Shack)*
1,780,870 Jocelyn Gagne, St-David, Quebec
1,761,030 Eric Mellon, Newark, DE
1,666,670 Lise Gagne, St-David, Quebec
1,557,100 David Reash, Hadley, PA

REACTOID *(Radio Shack)*
8,055 Gary Budzak, Westerville, OH

RED WARRIOR *(Radio Shack)*
5,488 Scott Godfrey, Nashua, NH
4,164 Roger Rance, Charleston, SC
4,011 Erin Carlton, Charleston, SC

RESCUE ON FRACTALUS *(Epyx)*
1,000,948 Steven Ujvary, Calgary, Alberta
323,167 Kenneth Hill, Severna Park, MD

RETURN OF JUNIOR'S REVENGE *(Colorware)*
2,053,100 Teresa Grant, Groton, CT
1,792,800 Chad Presley, Luseland, Saskatchewan

ROGUE *(Epyx)*
1,000,143 David Ring, Lyman, NE
71,833 Jon Fogarty, Yale, MI
65,529 Joseph H. Campbell, Norfolk, VA
15,400 Denny Turner, Virginia Beach, VA

SAILOR MAN *(Tom Mix)*
427,700 Marnie Schalm, Edson, Alberta
332,200 Jason Downs, Albany, OR
247,900 Jason Bauer, Menominee, MI
243,300 Scott Waterlander, Benton Harbor, MI
231,900 Jessica Wilkins, Seymour, TN

SANDS OF EGYPT *(Radio Shack)*
67 Tristan Terkuc, Richmond, Ontario
82 Edward Rocha, Cobleskill, NY

SAUCER DEFENSE (THE RAINBOW, 4/87)
95,000 Kevin Hilton, Conway, AZ
40,000 David Hartmann, Osoyoos, British Columbia

SCRATCH GOLFER (THE RAINBOW, 3/89)
63 Leif Smedberg, Churubusco, IN
62 Frank Sedlarcik, Carmel, NY
61 Jay Wood, Alexandria, MN

SHAMUS *(Radio Shack)*
61,745 Scott Galvao, Tiverton, RI
50,840 Chris Kremo, Bethel, CT
20,870 Larry Fuhrmann, Jr., Lynnwood, WA

SHOOTING GALLERY *(Radio Shack)*
39,930 Patricia Strakey, Littleton, CO
27,270 Jocelyn Hellyer, Montgomery, IL
25,870 Helder Santos, Montreal, Quebec
25,510 Donald Knudson, Minot, ND

SHOOT'N RANGE (THE RAINBOW, 8/87)
55,623 Paul Robbins, Picayune, MS
14,702 Richard Winkelbauer, Bronx, NY
13,794 Phillip Holsten, Modesto, CA

SHOPPING SPREE (THE RAINBOW, 7/89)
52 Jason Bauer, Menominee, MI

SILPHEED *(Game Arts)*
107,577 Josh Encarnation, Omaha, NE
93,351 Shan McKinney, Horton, AL
80,603 Frankie DiGiovanni, Olney, MD

SLAY THE NERIUS *(Radio Shack)*
73,091 Jeff Remick, Warren, MI
65,921 Chris Lucero, Denver, CO
63,476 Chris Kremo, Bethel, CT
21,410 Scott Severtson, Jamestown, NY

SNEAKY SNAKE (THE RAINBOW, 8/87)
137 Guy Greene, Bradenton, FL
102 Mike Alt, San Juan Capistrano, CA
91 Chris Nuwer, Lockport, NY

SPACE ASSAULT *(Radio Shack)*
49,070 John Stokes, Osoyoos, British Columbia
13,110 Jeff Remick, Warren, MI
7,280 Jason Kopp, Downs, IL
6,750 John Weaver, Amsterdam, NY
6,120 David Weaver, Amsterdam, NY

SPACE INVADERS *(Spectral Associates)*
3,920 Ari Enkin, Neapen, Ontario

SPEED RACER *(MichTron)*
103,120 Ricky Turkett, Marlow, OK
97,400 Jeff Morrison, Marlow, OK
96,420 Karen Rimiller, Adams, NY
96,000 Amber Reymonds, White City, Saskatchewan

SPEEDSTER (THE RAINBOW, 8/87)
250,500 Kevin Hilton, Conway, AZ
211,300 Paul Robbins, Picayune, MS
117,080 Bill Millington, Meriden, CT

SPIDERCIDE *(Radio Shack)*
27,730 Mike LeBrun, Cornwall, Ontario

SPRINGSTER *(Radio Shack)*
379,210 Wayne Roberts, Stillwater, OK
303,520 Mavis Hartmann, Osoyoos, British Columbia
200,670 Denise Root, Thorndale, PA
41,230 Jason Trammel, Murphysboro, IL

STAR BLAZE *(Radio Shack)*
9,150 Amy Schiller, Denmark, WI
8,950 Richard Durksen, Grunthal, Manitoba
6,550 Flint Weller, Swarthmore, PA

STOCK 3 (THE RAINBOW, 11/88)
77,386,525 Guy Greene, Bradenton, FL

STRATA (THE RAINBOW, 5/88)
4,380 Blain Jamieson, Kingston, Ontario
4,040 Ryun Schlecht, Gackle, ND
3,110 Kathy Rumpel, Arcadia, WI
2,992 Alan Lindaberry, Thorndale, PA

SUPER PITFALL *(Radio Shack)*
2,373,000 Danny Lee Fye, Independence, MO
1,995,000 Joel W. Carmichael, Pine Bush, NY
1,930,000 Phyllis Cross, Indianapolis, IN
1,752,500 Bruce Hoffsommer, Ridley Park, PA
1,723,000 Robert Young, Mildmay, Ontario
1,708,000 John Lipstraw, Rising Star, TX
1,700,000 Tom Jones, Milan, IL

TEMPLE OF ROM *(Radio Shack)*
604,000 Troy Graham, Arnold, MD
507,700 Adam Broughton, Morris, PA
303,600 Tim Hennon, Highland, IN

TETRIS *(Radio Shack)*
9,110 John Freidrich, Natrona Heights, PA
7,551 Joel W. Carmicael, Pine Bush, NY
7,402 Jason Downs, Albany, OR
7,092 Chris Kremo, Bethel, CT
6,224 Lori Harvey, La Porte City, IA
6,122 Maggie Hackbarth, Clayton, NY
5,955 John Kreiley, Rochester, NY
5,662 Jimmy Garner, Fort Worth, TX
4,258 Chuck Lehotsky, N. Jackson, OH

THEXDER *(Sierra On-Line)*
3,001,300 Joseph Cheek, West Jordan, UT
2,033,000 Frankie DiGiovanni, Olney, MD
2,011,200 Travis King, Montrose, WV
1,823,900 Tom Gauwitz, Roanoke, IL
1,411,700 Steve Hallin, Biloxi, MS

TIME BANDIT *(MichTron)*
76,030 Brent Morgan, Centerville, OH
59,020 Stephanie Morgan, Centerville, OH

TOADER (THE RAINBOW, 2/89)
7,047 Jessica Wilkins, Seymour, TN
5,117 Jon Hobson, Plainfield, WI

TREKBOER *(Mark Data)*
123 Roy Grant, Toledo, OH
132 Matthew Fumich, Munford, TN

TRIG ATTACK *(Sugar Software)*
196,000 Cassaundra Stewart, Sacramento, CA

TUT'S TOMB (THE RAINBOW, 7/88)
54,344 Brian Brame, Lakeside, CA
53,280 William Currie, Bryans Road, MD
24,190 Keith H. Pendley, Montgomery, AL

VARLOC *(Radio Shack)*
2,502 Frank D'Amato, Brooklyn, NY
2,032 Tony Harbin, Cullman, AL
2,032 Edward Rocha, Cobleskill, NY

VICIOUS VIC (THE RAINBOW, 7/86)
18,813 Talib Khan, Bronx, NY
15,063 John Conley, Everett, WA

WARRIOR KING *(Sundog Systems)*
46,100 Asher Martin, Woodridge, IL
33,050 Dan Deason, Reno, NV
31,800 Jason Cotting, Jackson, MS
30,500 Mike Sobjak, Reading, PA
18,700 Jason Bauer, Menominee, MI

WILDWEST *(Tom Mix)*
52 Farrell Kenimer, Phoenix, AZ
35 Paul Summers, Orange Park, FL

WISHBRINGER *(Infocom)*
400/201 Brad Wilson, Lithia Springs, GA

WIZARD'S DEN *(Tom Mix)*
593,950 Richard Winkelbauer, Bronx, NY
467,000 David Reash, Hadley, PA
425,350 Leif Smedberg, Columbia City, IN
195,050 Mark Touchette, Preston, CT

WRESTLE MANIAC *(Diecom)*
956,971 Marc Reiter, Cincinnati, OH
546,315 Louis Bouchard, Gatineau, Quebec

XENION *(Diecom)*
429,530 Chris Delerlein, Peekskill, NY
159,190 Charles Rene de Catret, Saint-laurent, Quebec

ZAKSUND *(Elite Software)*
557,900 Tom Cherubino, Brooklyn, NY
357,550 Martin Parada, Arcadia, CA
268,350 Tony Bacon, Mt. Vernon, IN

ZAXXON *(Datasoft)*
2,061,000 Byron Alford, Raytown, MO
1,950,000 Blake Cadmus, Reading, PA

ZONERUNNER *(Radio Shack)*
65,535 Scott Godfrey, Nashua, NH
65,535 Mike Woycheshen, Coquitlam, British Columbia

ZORK *(Infocom)*
350/328 Konnie Grant, Toledo, OH

Give us your best: Join the ranks of these courageous CoCoists in showing the Color Computer world your high score at your favorite micro-diversion. We want to put your best effort on record in THE RAINBOW's bimonthly "Scoreboard" column. All entries must be received 60 days prior to publication. Entries should be printed — legibly — and must include your *full* name, address, game title, company name and, of course, your high score. Each individual is limited to three score entries per month. Send your entries to Scoreboard, c/o THE RAINBOW.

For greater convenience, your high scores may also be sent to us through the MAIL section of our Delphi CoCo SIG. From the CoCo SIG>prompt, pick MAIL, then type SEND and address to: EDITORS.

★★★★★★★★ SCOREBOARD POINTERS ★★★★★★★★

In conjuction with THE RAINBOW's Scoreboard, we offer this bi-monthly column of pointers for game-playing readers' benefit. If you have some interesting hints, tips or responses to questions, or want help yourself, we encourage you to write to the Scoreboard, c/o THE RAINBOW.

In response to questions from:

- Harrison Feltner: In *White Fire of Eternity*, to get the pickaxe you have to first get the axe and rag. Then go to the forest and type `CHOP TREE`. Go to any tree except the big dead one. The computer will say you put a big gash in the tree and there is sap. Type `GET SAP` and the sap will saturate the rag. Now go back to the shrine and type `PUT RAG ON PICKAXE`. Now you can get a good grip on the pickaxe. Type `GET PICKAXE`.

Richard Owen
Niceville, Florida

- Kristy Craig: To enter the German air base in *Interbank Incident*, take the newspaper to where the guard is and read it. You may find an item and will also be able to enter the air base any time after that.

Frank DiGiovanni
Ashton, Maryland

- Tanya Pelly: In *Pyramid 2000*, as far as I know the maze contains only a vending machine. To get out, keep going until you find a pit.

- Andrew Yarrows: There are more than two people in the *Seventh Link*. I found Juliano, a sage, in the town that sells ships and flying disks. Buy a disk and follow a stream south. You will find more merchants. Go west across the stream and you will find islands connected by planking. Juliano is on one of them.

I also found Dirilia in a town to the south-west of the castle. You need a pirate ship to get her.

In the Castle Thoro dungeon, how do you get past the Maze of Water level.

Robbie Wiedeman
New London, Missouri

Scoreboard:

I need help on *Castles of Tharoggad*. In the level where I find a magic match, I also find a torch. When I try to light the match, nothing happens. I cannot get through this level. Is there a secret door here? What do I do with the match? Are there invisible doors like in *Dungeons of Daggorath*. If so, how do I see them?

Nathan King
Frenchtown, Montana

Scoreboard:

In *Dallas Quest* I've gotten to the cave entrance, but the natives won't let me pass. The clue says to use the ring, but how do you use it? I've tried everything. Please help!

Amanda Russo
Greensboro, North Carolina

Scoreboard:

In *Dallas Quest* be sure to close the pouch after falling out of the tree. You will need it to use the dinghy.

How do you get the flashlight in *Dallas Quest*?

Drax Felton
Aliquippa, Pennsylvania

Scoreboard:

Hints for Oblique Triad's *The Seventh Link*: Castle Thoro (the castle you begin next to) is well worth exploring, but you need keys. The locked doors are two different shades of color, depending on which key (small or large) you need. Keys may be bought in almost every town. There is a vendor who sells keys in the dungeons of Thoro. To enter them, find the door in the far east and go north. Follow the maze below the ladder in the northeast corner, and you'll find pools of healing and curing to be used as often as you like. Also below are a series of cells. Look at them all: Only in one of them does the prisoner not walk around. Free him (a thief) and ask him to join you.

Once you have the keys, go into the eastern corridor again and head north. Take the second west passage, unlock the door in the northeast part, and climb down to the ship below. The ship will take you almost anywhere in the dungeons, including the healing pools and a huge treasure in the far southeast. In the same area, find the grassy island and read the sign on it.

I've gotten a good deal further than this, but it should help you get started.

John Tynes
Columbia, Missouri

Scoreboard:

I am wondering where the central computer is on Level 15 in *Thexder*. I have been through levels 20+, and I have not seen a sign of the computer. The ad says there is one, but where? I'd appreciate any help.

David McCoy
Franklin, North Carolina

Scoreboard:

How do you get past the sonic lock on Level 5 of *Robot Odyssey*?

John Hampton
Keyport, New Jersey

To respond to other readers' inquiries and requests for assistance, reply to "Scoreboard Pointers" c/o THE RAINBOW, P.O. Box 385, Prospect, KY 40059. We will share your reply with all "Scoreboard" readers in an upcoming issue. For greater convenience, "Scoreboard Pointers" and requests for assistance may also be sent to us through the Mail section of our Delphi Coco SIG. From the CoCo SIG> prompt, pick Mail, then type `SEND` and address to: `EDITORS`. Be sure to include your complete name and address.

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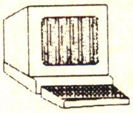

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Now there's a way to save lost files on crashed disks

To the Rescue

by Steve Ricketts

Have you ever tried, without success, to fix a crashed disk with your favorite zapper? Often the problem is that many of the disk sectors are filled with junk left over from killed files. *CoCoClean* comes to the rescue. *CoCoClean* is not a repair utility but an aid to make repairs easier.

When you kill a file in Disk BASIC, all you have done is to destroy some of the information telling the CoCo where to find that file, making it appear as if the file no longer exists. But that file is still out there in its previously allocated sectors.

CoCoClean first searches the Granule Allocation Table (GAT) for bytes containing a `CHR$(255)`, indicating an available granule. It then goes out to the first sector of that granule and looks at the first 128 bytes. If the first 128 bytes of the sector all contain `CHR$(255)`, the program ignores the entire granule, assuming there is nothing there. However, if the 128 bytes contain anything else, the program sees this as an old, killed file and rewrites the nine sectors of that granule with `CHR$(255)`, in effect performing a `DSKINI` on just that granule. Then it returns to the GAT to check the next byte and so on until all 68 granules have been checked.

Now *CoCoClean* goes to work on the directory. When you kill a file, a `CHR$(0)` is placed in the first position of the filename, making it invisible to Disk BASIC when you type `DIR`. The program finds all the filenames in the directory that do not contain a `CHR$(0)` in the first position and assigns them to a string variable. When it has completed reading the directory, it writes these variables back one after the other, thus eliminating the useless 32 bytes (killed filename fields).

To shorten the program a little, you can eliminate lines 10 through 30 and 180 through 210, as well as lines 50, 60, 320 and 340. ❑

Steve Ricketts is a computer operator for a multinational manufacturing firm in Portland, Oregon. He and his wife, Debbie, have been computing with the CoCo for 1½ years and enjoy telecommunications. He may be contacted at P.O. Box 828, Sandy, OR 97055.

32K Disk

30	79
90	99
180	250
270	203
END	18

The Listing: COCOCLN

```
0 ' COPYRIGHT 1989 FALSOFT, INC
10 CLS:PRINT"  "STRING$(29,42):P
RINT"  * COCO DISK CLEANUP UTILI
TY *":PRINT"  *     COPYRIGHT (C
) 1986    *":PRINT"  *       STE
VE RICKETTS      *":PRINT"  *
   BORING, OR 97009     *":PRINT
"  "STRING$(29,42):PRINT"  THIS
PROGRAM IS DESIGNED FOR"
20 PRINT"  PEOPLE LIKE ME WHO AR
E CON-":PRINT"  STANTLY SAVING/K
ILLING FILES":PRINT"  THEN HAVIN
G TO ZAP THE DISK":PRINT"  FOR W
HATEVER REASON AND RUN-":PRINT"
 NING INTO PROBLEMS BECAUSE ":PR
INT"  OF ALL THE GARBAGE LEFT OV
ER"
30 PRINT"  ON THE TARGET DISK.":
PRINT"      any key to continue"
:EXEC44539
40 CLS:CLEAR5500:C$=STRING$(128,
CHR$(255)):D$=C$:DIMF$(78),M$(82
),G$(20),H$(20):M=1:N=1:D=1
50 CLS:PRINT" THIS PROGRAM WILL
SEARCH THRU":PRINT"  THE DISK AN
D CLEAN IT OF ALL":PRINT"   OLD
INFORMATION LEFT OVER":PRINT"  F
ROM PREVIOUSLY KILLED FILES"
60 PRINT:PRINT"    any key to be
gin cleanup":EXEC44539
70 DSKI$0,17,2,A$,B$:G=1
80 G$=MID$(A$,G,1):T=(G-1)/2
90 IF T=INT(T) THEN S=1 ELSE S=1
0
100 T=INT(T):IF T>16 THEN T=T+1
110 IF G$=CHR$(255) THEN GOSUB13
0
120 IF G=68 THEN 180 ELSE G=G+1:
GOTO80
130 DSKI$0,T,S,E$,F$
140 IF E$=C$ THEN RETURN
150 PRINT"      CLEANING GRANULE
";(G-1)
160 FOR K=S TO S+8:DSKO$0,T,K,C$
,D$
170 NEXT K:RETURN
180 CLS:PRINT"  UNALLOCATED GRAN
ULES ON THIS":PRINT"      DISK A
RE NOW CLEAN.":PRINT
190 PRINT:PRINT"   SORTING OUT O
LD DIRECTORY":PRINTSTRING$(10,32
)"ENTRIES NOW"
200 'LOOK AT AND CLEAN UP KILLED
210 'DIRECTORY ENTRIES
220 FOR L=3 TO 11
230 DSKI$0,17,L,A$,B$
240 FOR C=1 TO 2
250 IF C=1 THEN C$=A$ ELSE C$=B$
260 FOR S=1 TO 127 STEP 32
270 F$(N)=MID$(C$,S,32):IF LEFT$
(F$(N),1)<>CHR$(0) THEN N=N+1
280 NEXT S:NEXT C:NEXT L
290 FOR M=1 TO N STEP 8
300 IF M>68 THEN 320
310 FOR L=0 TO 3:G$(D)=G$(D)+F$(
M+L):H$(D)=H$(D)+F$(M+L+4):NEXTL
:D=D+1:NEXTM
320 PRINT:PRINT"   WRITING OUT N
EW DIRECTORY"
330 FOR L=1 TO 8:DSKO$0,17,L+2,G
$(L),H$(L):NEXTL
340 CLS:PRINT@236,"FINISHED":EXE
C44539:CLS
```

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– DMP 120	6.75	7.75	–
– DMP 130/132	5.25	6.50	7.95
– DMP 200	6.75	7.75	–
– DMP 230/520	4.00	5.25	–
– DMP 410/510	5.00	7.00	–
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A Digital Lesson, Part 2

by Tony DiStefano
Contributing Editor

Before I start into this month's lesson, let me tell you about the last RAINBOWfest. At the DISTO/CRC booth there were two new and exciting products: A book called *The Full Turn of the Screw* is a collection of all my articles from January 1983 to July 1989, and you can get it at your favorite CoCo dealer (see the ads in THE RAINBOW), and there is a memory upgrade for the CoCo 3. With this adapter you can upgrade your CoCo 3 from 512K to 1 Meg of memory. It will be available by the time you read this.

Well, enough said for that, let's get on with it. I'll start with a short review of truth tables, look into the TTL family of gates, then follow up with a detailed look at some of the TTL gates I use in projects and products I design.

I finished off last time with basic logic gates and an overview of digital logic. In the case of simple gates, it's easy to tell what the output will be, given certain input conditions. For example, take a two-input AND gate. Given the description of the AND gate, the output is simple. When the two inputs are High, the output is High — A AND B = Y. But when you have a more complex gate, it's not that simple. If a chip you need has six inputs and eight outputs, the formula for all possible outputs is quite long. In fact, you need eight formulas; one for each output. As an example, the 74LS138 is a TTL gate that has six inputs and eight outputs.

Families of Families

When I refer to a TTL chip, I mean the family of logic gates known as the 74 series. This is a series of chip packages that have common input, output, impedance and power characteristics. They are made to work with each other and most other computer components, such as those found in your CoCo. Any microprocessor-based device such as a computer, printer, disk drive, monitor or adapter uses these chips.

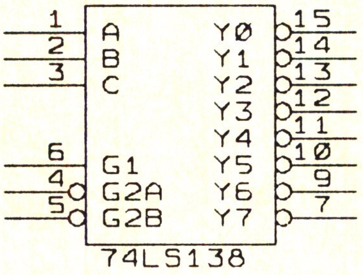

Figure 1A

There are many families in these series. You can tell which family a particular chip comes from by the letters that follow the 74. The LS family, for instance, is perhaps the most popular of all the families. Then comes the 74S (Schottky) series, i.e., 74S138. This family is generally faster than regular TTL. Next comes the 74LS (Low-power Schottky) family, which is not as fast as the 74S series but consumes much less power. These three families were around for a long time before the speed revolution came.

The presence of faster and faster CPUs generates the need for faster and faster support logic — the TTL stuff. Today there are many families of TTL. The 74F (Fast) family (74F138) is designed for the super-fast computer. The 74HC (Hi-Speed CMOS, 74HC138) is made to draw very low power for the portable and laptop devices. Then there is the 74HCT (Hi-Speed CMOS TTL), which is a drop-in replacement for the regular TTL. More families include ALS (Advanced Low-power Schottky), HCTLS, CLS, AS and so on, with new ones coming out every year.

To Tell the Truth

Each output may be represented by a formula. Eight outputs means eight formulas. Here is the formula for just one of the outputs:

```
Y1 = *A AND *B AND *C AND *G2B AND *G2A
AND G1
```

(where * means NOT)

In this case NOT means Low, but it does not necessarily mean Low all the time. If Q is active High, then *Q is Low. If Q is active Low, then *Q is High. Got that? (Active means the state of an input or output when the conditions are met for a given gate. For example, if a gate has one output that is normally High and goes Low when certain input conditions are met, this output is active Low.) Anyway, you get the idea that a formula for an output is not immediately

TRUTH TABLE

ENABLE		SELECT			OUTPUTS							
G1	G2	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

X = Irrelevant (any input including transitions)

Figure 1B

Tony DiStefano is a well-known early specialist in computer hardware projects. He lives in Laval Ouest, Quebec. Tony's username on Delphi is DISTO.

clear, while a truth table would be simpler. In the case of the 74138, there are eight formulas that describe the eight outputs. A truth table, at first, seems to contain more information than that of the formulas, but in the long run it is simpler to use.

Figure 1a is the pinout for a 74LS138 TTL chip, which is a three-line to eight-line decoder/multiplexer used mainly for memory decoding and expansion. You have seen me use this chip over and over again. Remember binary? One bit has two states, two bits has four, and three bits has eight. This is where it comes in handy. You can use a 74138 to decode, for example, three address lines into its eight separate memory locations. Inputs A, B and C would connect to Address lines A0, A1 and A2. The other three inputs to the 74138 can be used to further decode the memory locations or to gate other conditions. For example, if you were to tie the R/*W line of the CPU to G2A, this chip would be active only when the CPU is writing. Use an invertor with the R/*W line and the chip would only read. Another trick would be to tie the R/*W line to Input C of the chip. This would cut down the needed memory locations because you would no longer have A2 connected. Instead, the R/*W line would divide the eight outputs into four read outputs and four write outputs.

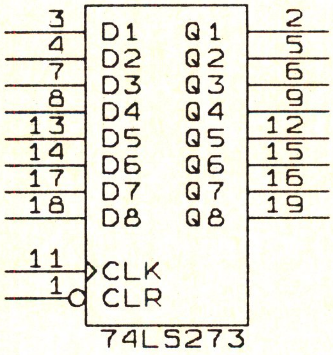

Figure 2A

Figure 1b has the truth table for the 74138 chip. It tells you the relationship between the inputs and the outputs. By tying different combinations of CPU lines to these inputs, the 74138 can perform different functions. These functions are governed by the particular needs of the circuit.

The next chip I'll look into is the 74273, which is an octal D-type flip-flop with a Clear gate. Octal means that there are eight flip-flops, which is great for the CoCo because it uses an eight-bit bus; a perfect match. Look at Figure 2a; it shows a pinout of the 74273. The numbered D pins are the input pins and normally connect to the data pins of the CoCo — or any other CPU — pin for pin. The numbered Q pins are the outputs. Each numbered output matches with the numbered inputs. For instance, the output of 3D is 3Q. The inputs and the outputs of this chip take up most of the pins

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for this package. Except for the ground and Vcc pins, there are two other control pins on the chip.

> **You must find a way to make sure that there is only one device outputting on the data bus at any given time. The method is called tri-state.**

The first is the *CLR pin. As the acronym suggests, CLR stands for clear. This pin is an active Low signal that when activated clears all the outputs to Low. This pin may be CPU-controlled as a memory-mapped byte or may be connected to the system *RESET, which has the same polarity. Now comes the trickiest pin of the package, the CLK pin. Yes, it does mean clock. This clock pin is a little different from the other pins in this package or even all of the pins in the 74138 package as well. All the other pins mentioned here today are level-activated. When a given pin goes Low, there is a direct result of that action. A clocked pin acts very different because it is edge-activated. The signal of an edge-activated pin may stay High or Low; it doesn't matter. What matters is the transition between the two states. In the case of the 74273, it is a positive transition that activates the chip. When the signal changes from Low to High, it is called an edge. Because the direction of this edge is from Low (0 volts) to High (5 volts), it is a positive edge. The CLK signal type of a 74273 is positive-edge triggered. Figure 2b shows this edge trigger as an up arrow in its truth table.

Okay, we now know how it's triggered, but what does the trigger do? Well, in the case of the 74273, at the exact trigger time (the precise time that the CLK signal changes from Low to High), whatever data appears on the chip's data pins (1D to 8D) is transferred and latched (memorized) into the output pins (1Q to 8Q). Once the data has been latched into the outputs, they do not change again until the next trigger to the CLK pin. You use this chip whenever you need latched data output bits. The outputs now can be used to control inputs to other gates or can be used to control devices such as LEDs, small relays, motors or other devices that will work with 5 volts at very little current. In fact the current these output pins can handle is limited to 8 mA for the 74LS273 and 16 mA for the 74ALS273. I think LEDs are the perfect device for this chip. Connect them with a 470 ohm resistor to make a great light show.

The next chip in our digital library is the opposite of the 74273. The 74244 is used as a buffer or as a device to read eight bits. It is an octal buffer with three-state outputs. Look at Figure 3, which shows the pinout of a 74244. You see a bunch of numbers, I know — but once you know how they work, it all makes sense. All the pins with the letter A are inputs, and all the pins with the letter Y are outputs. There are two groups of inputs/outputs; the 1's group and the 2's group. Each group contains four I/O pairs.

INPUTS			OUTPUT
CLEAR	CLOCK	D	Q
L	X	X	L
H	^	H	H
H	^	L	L
H	L	X	Qo

↑= Transition from Low to High level
Q̲= Level of Q before the indicated steady-state input conditions were established

Figure 2B

The first number is the group number, then comes the I/O letter and finally the bit number. In all, there are eight inputs and eight outputs. The inputs are always inputs. Make sense? The outputs, on the other hand are not always outputs. Sometimes they are outputs and sometimes they are nothing. I mean they are not driving High or Low, but are high-impedance, tri-state or open circuit.

This state of *open circuitness* is good in a system such as the CoCo. Many inputs and outputs from different chips talk to each other on the same 8-bit data bus in a computer system. But in order to keep the outputs from one chip from fighting with the outputs of another, you must find a way to make sure that there is only one device outputting on the data bus at any given time. The method is called tri-state. If there are many chips that can output data on the same bus, all the outputs must be in tri-state *except* the device that must output. This is memory mapping and the Read/*Write line. The R/*W line determines which direction the data flows, and the memory mapping determines which device is active. The 74244 has two tri-state control pins, one for each group. The bar on top of each pin means that it is active Low. When the *1G and *2G pins are nonactive High, the outputs to the 74244 are in their tri-state modes. When the control pins are Low, whatever data is found on the respective input pins appears on the output pins.

As you can see, tri-state is useful in adding devices to a bus-type computer like the CoCo. Let's look again at Figure 3. We know that the inputs (A) are straightforward. We also know that the outputs are tri-state. Therefore we can use this chip to read the inputs into the CPU's data bus. We can do this in the following manner: First connect the input pins of the 74244 to the chips or devices, such as switches, we want the CPU to read. Then connect the output pins of the 74244 to the data bus of the CPU. In this configuration, because the output of the 74244 is connected directly to the CPU's data bus, the control pins must normally be in their nonactive state. Then, with the proper memory mapping circuit and the read side of the R/*W line, the 74244 outputs the data to the CPU what is on the input side of the 74244.

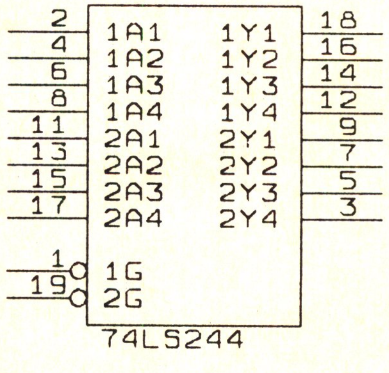

Figure 3

These three TTL parts are staple foods in the computer world. Using back issues or my book, you can go back and review all my projects and all the instances when I have used these chips. You can now study the diagrams and better understand what I was doing then. Next time, I'll look into more of these TTL chips and into understanding the components of digital circuits.

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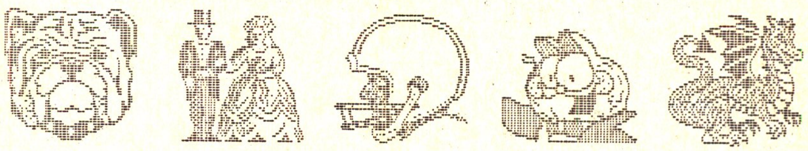

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Utilities

Lowercase and Colors Too

by George R. Mabry

CoCo 3

The *Locase* program adjusts the colors and actuates a true lowercase text screen for a 32-, 40- or 80-column display on a CoCo 3. The switch between displaying all uppercase letters vs. a typewriter type of upper- and lowercase display is accomplished by simultaneously pressing the shift key and the 0 key. After colors and the lowercase characters have been selected, running another BASIC program will not alter the display colors or the upper- and lowercase format.

Changing Line 40 to make `A` equal to any value from 0 to 63 causes *Locase* to select different foreground color. Similarly, changing Line 50 to make `B` equal to any value from 0 to 63 displays the various background colors. The values for `A` and `B` as shown in the listing cause the foreground color to be white and the background color to be black. This appears to work very well on an RGB color monitor. When a small color TV set is used as a monitor, it may be better to make `A=0` and `B=63` to reverse the display colors.

Making `C` equal to 16 causes *Locase* to activate a true lowercase display. To retain the normal reversal of foreground and background colors to represent lowercase letters, change Line 60 to make `C=0`.

If you would like to see all possible color combinations displayed on the screen, add the following lines before running the program:

```
62 FOR A=0 TO 63
64 FOR B=0 TO 63
162 PRINT “A=”A;”B=”B
164 NEXT B
166 NEXT A
```

If this program takes too much time, the 64 background colors can be displayed by deleting lines 62 and 166.

The Listing: `LOCASE`

```
0 ‘ COPYRIGHT 1989  FALSOFT,INC
10 REM* PROGRAM ‘LOCASE.BAS’ *
20 CLEAR200,32599
30 DEFUSR0=32600
40 A=63
50 B=0
60 C=16
70 A$=”347FBDB3ED8632B180FD262BC
1102611F77FBC8639B795ACB6FF22BA7
FBCB7FF22867FB7FFB8B7FFBC8640B7E
03EB7E047B7FFB0B7FFBD357F39"
80 B$=HEX$(A+64)
90 MID$(A$,69,2)=B$
100 C$=HEX$(B+64)
110 MID$(A$,85,2)=C$
120 FOR D=0 TO 57
130 D$="&H"+MID$(A$,(2*D+1),2)
140 POKE (32600+D),VAL(D$)
150 NEXT D
160 E=USR0(C)
170 IF PEEK(33021)=50 THEN 190
180 CLEAR200,32767:GOTO 200
190 CLEAR200,32768
200 END
```

Attributes

by Glenn J. Christensen

CoCo 3

If I am using `PALETTECMP:PALETTE11,59:ATTR7,5`, can you tell me off the top of your head what color combinations I am looking at? How about if I switch to `PALETTE RGB`?

Most of us, I suspect, would have to plug it in and take a look. Others will consult a neat little table they have generated for that purpose. A few might know.

My computer is a tool I use whenever it makes sense to do so. I do little computing for computing's sake. Still, I have nothing against a little color here and there, and as I write almost all of my working programs, I decided to trade in the old CoCo 2 for a CoCo 3 and liven up the display a bit.

It is easy enough for Tandy to say "64 colors," but look at the number of combinations you can go through to get there: Palette colors: 16 times 64 equals 1024.

Whew! . . . Whoops! I forgot, by changing to `CMP` or `RGB` we get 2 times 1024, or 2048.

And we're still not done. Attribute combinations are 8 times 8, which equals 64. This leaves one more: Multiply 64 times 2048, for a total of 131,072 possible ways to get just 64 colors! Those of you who can get it off the top of your head — well, my hat's off to you. I wrote `ATTR` to save me the drudgery of searching for the right colors to use in that next great program.

How The Program Works

`ATTR` randomly selects a palette color set, then randomly selects two sets of attributes. The attributes are displayed forward and in reverse. A keystroke allows you to switch back and forth between `RGB` and `CMP` displays. (The screen comes up in the `RGB` mode. You can view `CMP` by pressing C; the B key brings back RGB.) If the displayed combination is not to your liking, press R for another run. `ATTR` can show you up to eight combinations of color if you use both `CMP` and `RGB` in your program — more than enough color to display the text to your liking.

Suggested Modifications

- Using an `INPUT` statement, set in the palette color. This may be more useful for some programmers.
- Using `FOR/NEXT`, run through all possible combinations, making a catalog of hues and those that are useful. (131,072! — is he kidding?).

Good hunting!

The Listing: `ATTR`

```
0 ' COPYRIGHT 1989  FALSOFT,INC
6 WIDTH80
7 MA=RND(-TIMER)
8 POKE65497,0
9 VERIFYON
10 MA=RND(8)-1:MB=RND(8)-1:MC=RN
D(8)-1:MD=RND(8)-1:  REM  SELECT
 ATTRIBUTES
20 ME=RND(16)-1:MF=RND(64)-1:
                        REM  SELECT
 PALETTE COLORS
22 MG=RND(8)-1:
                         REM  CLEAR
 SCREEN COLOR
30 PALETTERGB
40 PALETTEME,MF
52 CLSMG
54 ATTRMA,MB
58 PRINT
60 PRINT"1.  PALETTE RGB - PALET
TE"ME;MF;:PRINT"-  ATTRIBUTES TH
IS LINE"MA;MB
61 PRINT:ATTRMB,MA:PRINT
62 PRINT"2.  ATTRIBUTES REVERSED
"MB;MA
70 PRINT:ATTRMC,MD:PRINT
80 PRINT"3.  ATTRIBUTES THIS LIN
E"MC;MD
81 PRINT
82 ATTRMD,MC:PRINT
84 PRINT"4.  ATTRIBUTES REVERSED
"MD;MC
92 PRINT:PRINT:PRINT:PRINT
100 GOTO1000
110 PALETTE CMP
112 ATTRMA,MB
114 PRINT
120 PRINT"1.  PALETTE CMP - PALE
TTE"ME;MF;:PRINT"-  ATTRIBUTES T
HIS LINE"MA;MB
121 PRINT
122 ATTRMB,MA:PRINT
124 PRINT"2.  ATTRIBUTES REVERSE
D"MB;MA
126 PRINT
130 ATTRMC,MD
132 PRINT
140 PRINT"3.  ATTRIBUTES THIS LI
NE"MC;MD
141 PRINT
142 ATTRMD,MC
143 PRINT
144 PRINT"4.  ATTRIBUTES REVERSE
D"MD;MC
150 PRINT:PRINT:PRINT:PRINT
999 GOTO1000
1000 PRINT"  BORDER IS A CLS"MG:
PRINT:PRINT:PRINT"  DEPRESS <C>
TO SEE ATTRIBUTES WITH PALETTE C
MP"
1010 PRINT"  DEPRESS <B> TO SEE
ATTRIBUTES WITH PALETTE RGB"
1012 PRINT"  DEPRESS <S> TO RAND
OMLY SELECT A NEW BORDER"
1020 PRINT"  DEPRESS <R> TO RUN
FOR A NEW RANDOM SET"
1022 POKE65496,0
1030 MH$=INKEY$:IF MH$="" THEN10
30
1032 POKE65497,0
1040 IF MH$="C" THENCLSMG:GOTO11
0
1050 IF MH$="B" THENCLSMG:GOTO30
1060 IF MH$="R" THENRUN
1062 IF MH$="S" THEN MG=RND(8)-1
1070 CLSMG:GOTO1000
```

Graphics

The CoCo Signal

by Steven Kuntz

CoCo 3

If your CoCo shows signs of a software snafu, a programming problem or a hardware glitch, or if an invasion of the Blue Meanies from Clonezone occurs, don't go it alone. Sound the alarm and ask for the super hero help of the CoCo Crusader.

Instead of the Bat signal it's the CoCo signal! There are graphics, a line of screen text, and the sound of the telephone hotline ringing off the hook.

The Listing: `HCAT`

```
0 ' COPYRIGHT 1989  FALSOFT,INC
1 'HCAT SHK 10/89
2 ON BRK GOTO 999
20 RGB: HSCREEN 1: PALETTE 0,0
30 HCOLOR 1
50 HPRINT(4,21),"CHIEF, GET THE
COMPUTER CRUSADER,"
60 HPRINT(12,23),"SEND FOR COCO
CAT!"
100 HCIRCLE(160,64),32,1,1,.48,.
6:HCIRCLE(160,64),32,1,1,.66,.84
:HCIRCLE(160,64),32,1,1,.9,.033
200 HDRAW"S10;BM190,68M+7,+2M+3,
+3D4M-1,+3M-8,+1M-14,-1M-15,+1M-
5,-1M-1,-3M+1,-3M+3,-3M+3,-2M+3,
-1
210 HDRAW"BM174,36M+6,-9M-2,+12
220 HDRAW"BM143,39M-6,-9M+3,+12
300 HDRAW"BM157,72U2R3D2L3
310 HDRAW"BM170,56D2L1U2R1BM154,
56D2L1U2R1
400 HCIRCLE(160,70),100,1,.70
450 HPAINT(160,120),1,1
500 HCOLOR 0
510 HDRAW"BM207,80M+11,-3M+3,+1B
M212,88M+6,+1M+4,+2BM211,98M+5,+
2M+2,+2BM112,82M-6,-1M-5,+2BM110
,88M-7,+1M-4,+3BM108,96M-6,+4
600 PLAY"L20V31T5005GBGBGBGBGBGB
GBGBGBGBGBGB":FOR QQ=0TO399:NEXT
 QQ
610 SOUND 90,10
620 GOTO 600
999 RGB
```

Categories

by R.M. Ehrenberg

16K
Extended

Are you bored with playing *Monopoly* or *Trivial Pursuit* at party after party? Well, here is a game that changes every time you play; any number can play, even just one. *Categories* can be played by anyone old enough to read and spell and can be changed to suit your own tastes.

The program begins by picking five random letters and categories. It then asks for the number of players and prints up game boards — two per page — for every player. Everyone fills out the five-by-five grid as best he can for the agreed-upon time limit. The person with the most answers filled in wins.

Line 0 clears the screen; lines 10 through 50 give the title screen; lines 60, 70 and 80 load and select the letters and categories; and lines 90 through 120 draw the grid, with subroutines in lines 200 and 300 to draw the lines. Data lines 310 through 350 contain the categories, which can be changed to suit your particular desires.

The Listing: CATS

```
0 CLS
5 ' COPYRIGHT 1989  FALSOFT,INC
10 PRINT"************************"
20 PRINT"    R.M. EHRENBERG"
30 PRINT"         PRESENTS"
40 PRINT"       CATAGORIES"
50 PRINT"************************"
60 DIMA$(25):FORA=1TO25:READA$(A
):NEXTA:FORA=1TO5
70 B$(A)=CHR$(RND(26)+64):FORB=0
TOA-1:IF B$(A)=B$(B)THEN70 ELSE
NEXTB
80 C$(A)=A$(RND(25)):FORB=0TOA-1
:IF C$(A)=C$(B)THEN80 ELSE NEXTB
:NEXTA
90 INPUT"NUMBER OF PLAYERS";P:FO
RA=1TOP:FORB=1TO4:PRINT#-2,CHR$(
13):NEXTB
100 GOSUB200:GOSUB300:PRINT#-2,T
AB(4)"!";C$(1);TAB(19)"!";C$(2);
TAB(34)"!";C$(3);TAB(49)"!";C$(4
);TAB(64)"!";C$(5):GOSUB200
110 FORC=1TO5:GOSUB300:PRINT#-2,
B$(C);:GOSUB300:GOSUB300:GOSUB20
0:NEXTC
120 PRINT#-2:NEXTA:END
200 PRINT#-2,STRING$(80,61):RETU
RN
300 PRINT#-2,TAB(4)"!";TAB(19)"!
";TAB(34)"!";TAB(49)"!";TAB(64)"
!":RETURN
310 DATA AUTOS,FOODS,BANDS,CITIE
S,COUNTRIES
320 DATA MENS NAMES,WOMENS NAMES
,SPORTS,ANIMALS,SONGS
330 DATA CIGARETTES,DRINKS,AIRLI
NES,COLLEGES,METALS
340 DATA ARTISTS,GASOLINES,SPORT
S TEAMS,BRIDGES,GAMES
350 DATA TOYS,MOVIES,TV SHOWS,RI
VERS,COLORS
```

Innkeeper

by Leroy Jones

4K
Standard

You are a new waiter in a bar with an innkeeper that serves drinks faster than you can utter "Cheers". *Innkeep* is a Color BASIC program in which you must catch a series of falling drinks with a serving tray.

The game begins with a Ready pause. The drink (asterisks) bounces back and forth along the top bar rail. The waiter is located at the bottom left of the screen. He has a tray on his extended right arm, which may be moved left or right with the corresponding arrow keys. Each drink caught is worth 10 points. Your score is displayed on the right side of the screen in the following manner:

P:	Points
M:	Misses
H:	High score

The high score counter displays the highest points achieved during game play. A Pause function is activated and deactivated by pressing the space bar; but while in the Pause mode, you can press E to end.

Once the player has missed three drinks with the serving tray, he or she has the option of either pressing Y to end the game or pressing N to play again. I hope you enjoy *Innkeep*. Remember, we don't serve Shirley Temples!

The Listing: INNKEEP

```
0 ' COPYRIGHT 1989  FALSOFT,INC
1 REM INNKEEP c1989 L.JONES
2 REM COLOR BASIC,4K
10 A$=CHR$(128):B$=CHR$(133):C$=
CHR$(138):D$=CHR$(131):E$=CHR$(1
40):F$=CHR$(32):CLS:FOR A=23TO40
7STEP32:PRINT@A,C$:NEXT:FOR A=41
6TO439:PRINT@A,D$:NEXT
15 FOR A=96TO224STEP64:PRINT@A,E
$;E$,"      ";E$;E$;:PRINT@A+32,C
$,"     ";C$;:NEXT:PRINT@152,"H:
"
20 FOR A=67TO291STEP32:PRINT@A,B
$,"    ";C$;:NEXT:FOR A=N TO17:P
RINT@35+A,E$;:PRINT@340-A,D$;:NE
XT:PRINT@24,"P:":PRINT@88,"M:":M
=N:IF P>H THEN H=P:PRINT@154,MID
$(STR$(H),2,6);
25 P=N:PRINT@22,C$;:PRINT@53,D$;
A$;:PRINT@85,E$;B$;:PRINT@321,A$
;:PRINT@352,C$;A$;D$;:PRINT@384,
E$;A$;E$;
30 PRINT@448,"READY":FOR A=1TO99
9:NEXT:PRINT@448,F$
35 D=51
40 R=RND(20):PRINT@D,E$;:IF D=36
THEN S=1ELSEIF D=51THEN S=-1
45 K$=INKEY$:IF K$=F$THEN70ELSEI
F K$=CHR$(8)THEN V=-1ELSEIF K$=C
HR$(9)THEN V=1
50 T=T+V:IF T<355THEN T=355ELSEI
F T>370THEN T=370
55 PRINT@T,D$;A$;A$;F$;:D=D+S:PR
INT@D,"*";:IF R>1THEN40ELSE S=32
:PRINT@D-32,F$;:IF D=T-31OR D=T-
30THENGOSUB65ELSEIF D<320THEN45E
LSE M=M+1:PRINT@90,M:SOUND170,9:
SOUND159,3:SOUND170,3:SOUND159,9
:SOUND147,13
60 PRINT@D,D$;:PRINT@D-288,E$;:I
F M<3THEN35ELSE G$=INKEY$:PRINT@
462,"GAME  OVER":IF G$="N"THEN20
ELSEIF G$="Y"THEN75ELSE60
65 P=P+10:SOUND239,1:SOUND244,1:
SOUND243,1:PRINT@26,MID$(STR$(P)
,2,6);:RETURN
70 PRINT@455,"PAUSE":P$=INKEY$:P
RINT@455,F$:IF P$=K$THEN50ELSEIF
 P$<>"E"THEN70
75 PRINT@462,"        END"
```

Mortgage

by John Porter

4K
Standard

This mortgage calculation program is designed to help you decide which route to take when getting a mortgage. The printouts read only in whole dollars and are accurate to within 49 cents per month.

When *Mortgage* is run, lines 60 through 70 perform the actual calculations, using figures input in Line 50. Line 100 asks if you want a printout and if so sends the program to Line 150 for the printer routine. Line 200 returns you to Line 120 to ask if you want another calculation.

Line 140 asks if you want to run the program again.

The Listing: `MORTGAGE`

```
0 ‘ COPYRIGHT 1989  FALSOFT,INC
10 ‘(C)1988 JOHN PORTER
20 ‘3 HASTINGS ST.
30 ‘ST.JOHNSBURY, VT. 05819
40 CLS:PRINT”***** MORTGAGE CALC
ULATION *****”;:PRINT:PRINT:
50 INPUT”LOAN AMOUNT”;L:INPUT”RA
TE OF INTEREST”;R:INPUT”YEARS OF
 LOAN”;Y
60 M=Y*12:R=R/1200:A=L*R:B=(1+R)
^-M
70 C=1-B:D=INT(A/C)
80 PRINT”LOAN AMOUNT - $”;L:PRIN
T”PAY   MONTHLY   -   $”;D
90 PRINT”ANNUAL COST - $”;D*12:P
RINT”TOTAL COST - $”;D*12*Y
100 PRINT”OUTPUT TO PRINTER? (Y/
N)”
110 B$=INKEY$:IFB$=””THEN110 ELS
E IF B$=”Y”GOSUB150ELSE 120
120 PRINT”ANOTHER CALCULATION? (
Y/N)
130 A$=INKEY$:IF A$=””THEN130
140 IF A$=”Y”THEN RUN ELSE END
150 PRINT#-2,CHR$(27);CHR$(31):P
RINT#-2,”LOAN AMOUNT=$”;L
160 PRINT#-2,”LOAN TERM =”Y”YEAR
S”
170 PRINT#-2,”INTEREST RATE =”R*
1200”%”
180 PRINT#-2,”MONTHLY PAYMENT= $
“;D
190 PRINT#-2,CHR$(27);CHR$(54)
200 RETURN
```

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Rainbow Info

How To Read Rainbow

When we use the term CoCo, we refer to an affectionate name that was first given to the Tandy Color Computer by its many fans, users and owners.

The BASIC program listings printed in THE RAINBOW are formatted for a 32-character screen — so they show up just as they do on your CoCo screen. One easy way to check on the accuracy of your typing is to compare what character "goes under" what. If the characters match — and your line endings come out the same — you have a pretty good way of knowing that your typing is accurate.

We also have "key boxes" to show you the *minimum* system a program needs. But, *do* read the text before you start typing.

Finally, the little disk and/or cassette symbols on the table of contents and at the beginning of articles indicate that the program is available through our RAINBOW ON DISK or RAINBOW ON TAPE service.

Using Machine Language

The easiest way to "put" a machine language program into memory is to use an editor/assembler, a program you can purchase from a number of sources. All you have to do, essentially, is copy the relevant instructions from THE RAINBOW's listing into CoCo.

Another method of putting an ML listing into CoCo is called "hand assembly" — assembly by hand, which *sometimes* causes problems with `ORIGIN` or `EQUATE` statements. You ought to know something about assembly to try this.

Use the following program if you want to hand-assemble ML listings:

```
10 CLEAR200,&H3F00:I=&H3F80
20 PRINT "ADDRESS:";HEX$(I);
30 INPUT "BYTE";B$
40 POKE I, VAL("&H"+B$)
50 I=I+1:GOTO 20
```

This program assumes you have a 16K CoCo. If you have 32K, change the `&H3F00` in Line 10 to `&H7F00` and change the value of `I` to `&H7F80`.

OS-9 and RAINBOW ON DISK

The OS-9 side of RAINBOW ON DISK contains two directories: `CMDS` and `SOURCE`. It also contains a file, `read.me.first`, which explains the division of the two directories. The `CMDS` directory contains executable programs and the `SOURCE` directory contains the ASCII source code for these programs. BASIC09 programs will only be offered in source form so they will only be found in the `SOURCE` directory.

OS-9 is a very powerful operating system. Because of this, it is not easy to learn at first. However, while we can give specific instructions for using the OS-9 programs, you will find that the OS-9 programs will be of little use unless you are familiar with the operating system. For this reason, if you haven't "learned" OS-9 or are not comfortable with it, we suggest you read *The Complete Rainbow Guide to OS-9* by Dale Puckett and Peter Dibble.

The following is not intended as a course in OS-9. It merely states how to get the OS-9 programs from RAINBOW ON DISK to your OS-9 system disk. Use the procedures appropriate for your system. Before doing so, however, boot the OS-9 operating system according to the documentation from Radio Shack.

1) Type `load dir list copy` and press ENTER.
2) If you have only one disk drive, remove the OS-9 system disk from Drive 0 and replace it with the OS-9 side of RAINBOW ON DISK. Then type `chd/d0` and press ENTER. If you have two disk drives, leave the sytem master in Drive 0 and put the RAINBOW ON DISK in Drive 1. Then type `chd/d1` and press ENTER.
3) List the `read.me.first` file to the screen by typing `list read.me.first` and pressing ENTER.
4) Entering `dir` will give you a directory of the OS-9 side of RAINBOW ON DISK. To see what programs are in the `CMDS` directory, enter `dir cmds`. Follow a similar method to see what source files are in the `SOURCE` directory.
5) When you find a program you want to use, copy it to the `CMDS` directory on your system disk with one of the following commands:

One-drive system: `copy /d0/cmds/` *filename* `/d0/cmds/`*filename* `-s`

The system will prompt you to alternately place the source disk (RAINBOW ON DISK) or the destination disk (system disk) in Drive 0.

Two-drive system: `copy /d1/cmds/` *filename* `/d0/cmds/` *filename*

Once you have copied the program, you execute it from your system master by placing that disk in Drive 0 and entering the name of the file.

The Rainbow Seal

RAINBOW
CERTIFICATION
SEAL

The Rainbow Certification Seal is our way of helping you, the consumer. The purpose of the Seal is to certify to you that any product that carries the Seal has actually been seen by us, that it does, indeed, exist and that we have a sample copy here at THE RAINBOW.

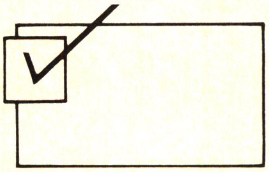
Manufacturers of products — hardware, software and firmware — are encouraged by us to submit their products to THE RAINBOW for certification.

The Seal is not a "guarantee of satisfaction." The certification process is different from the review process. You are encouraged to read our reviews to determine whether the product is right for your needs.

There is absolutely no relationship between advertising in THE RAINBOW and the certification process. Certification is open and available to any product pertaining to CoCo. A Seal will be awarded to *any* commercial product, regardless of whether the firm advertises or not.

We will appreciate knowing of instances of violation of Seal use.

Rainbow Check Plus



The small box accompanying a program listing in THE RAINBOW is a "check sum" system, which is designed to help you type in programs accurately.

Rainbow Check PLUS counts the number and values of characters you type in. You can then compare the number you get to those printed in THE RAINBOW. On longer programs, some benchmark lines are given. When you reach the end of one of those lines with your typing, simply check to see if the numbers match.

To use *Rainbow Check PLUS*, type in the program and save it for later use, then type in the command `RUN` and press ENTER. Once the program has run, type `NEW` and press ENTER to remove it from the area where the program you're typing in will go.

Now, while keying in a listing from THE RAINBOW, whenever you press the down arrow key, your CoCo gives the check sum based on the length and content of the program in memory. This is to check against the numbers printed in THE RAINBOW. If your number is different, check the listing carefully to be sure you typed in the correct BASIC program code. For more details on this helpful utility, refer to H. Allen Curtis' article on Page 21 of the February 1984 RAINBOW.

Since *Rainbow Check PLUS* counts spaces and punctuation, be sure to type in the listing exactly the way it's given in the magazine.

```
10 CLS:X=256*PEEK(35)+178
20 CLEAR 25,X-1
30 X=256*PEEK (35)+178
40 FOR Z=X TO X+77
50 READ Y:W=W+Y:PRINT Z,Y;W
60 POKE Z,Y:NEXT
70 IFW=7985THEN80ELSEPRINT
   "DATA ERROR":STOP
80 EXEC X:END
90 DATA 182, 1, 106, 167, 140, 60, 134
100 DATA 126, 183, 1, 106, 190, 1, 107
110 DATA 175, 140, 50, 48, 140, 4, 191
120 DATA 1, 107, 57, 129, 10, 38, 38
130 DATA 52, 22, 79, 158, 25, 230, 129
140 DATA 39, 12, 171, 128, 171, 128
150 DATA 230, 132, 38, 250, 48, 1, 32
160 DATA 240, 183, 2, 222, 48, 140, 14
170 DATA 159, 166, 166, 132, 28, 254
180 DATA 189, 173, 198, 53, 22, 126, 0
190 DATA 0, 135, 255, 134, 40, 55
200 DATA 51, 52, 41, 0
```

Kissable OS-9

Rumors From RAINBOWfest

by Dale L.Puckett
Contributing Editor

Rumors were running wild at RAINBOWfest Somerset, and before the weekend was over Dennis Skala thought he saw something he wasn't supposed to see — a new and improved OS-9 Level II for the Color Computer 3. It is faster, nearly bug free and has a lot of nifty features. In the long-standing tradition of most Pentagon public information professionals, all of the people at RAINBOWfest who knew what was going on — or should have known — could neither confirm nor deny the existence of a new OS-9. Dennis Skala was an inadvertent witness to a rather exciting development. He's sure there's a new version of OS-9 in the wings and shared this belief with me.

OS-9 Level II was running on a Color Computer 3 with an improved and more powerful windowing interface. "The program I saw on the screen was outstanding, and I'm sure I was looking at the operating system itself, not an application program," Skala said.

Skala described the mystery program as a Macintosh-like operating system with overlapping, moveable and dynamically resizeable windows. He also noticed significant improvements in the speed with which graphics were displayed on the Color Computer 3 and described an impressive demo program that featured a ball bouncing around on a background screen, partially obscured by a picture of the Mona Lisa.

Skala is sure the people from Tandy at RAINBOWfest were aware of the program's existence. He noticed, though, that everyone he talked to seemed to be very quiet about it.

> **Disappearing windows, locked shells, wrong palette registers returned by system calls, etc., may soon disappear for all OS-9 users.**

Skala believes a lot of the well-known people in the CoCo OS-9 world are involved and guesses that several thousand man-hours of work have gone into what he calls the Mona Lisa Project.

Officially, we have been unable to confirm anything about the Mona Lisa program Skala saw at Somerset. Tandy could be considering marketing an OS-9 upgrade, or Tandy could be licensing it to a third-party developer.

After doing some unofficial snooping, I feel Skala is right on track. I also believe that all OS-9 users may soon be able to take advantage of a new and improved version of Ron Lammardo's *Shell Plus* that many of us have been using. If the Mona Lisa is an upgrade, it most likely will squash many of the irritating bugs in Level II. Disappearing windows, locked shells, wrong palette registers returned by system calls, etc., may soon disappear for all OS-9 users — not just those who have downloaded patches from an electronic forum such as OS-9 Online or the OS-9 SIG.

Features that Skala did not see at Somerset, but wished he had, include full wildcards in the Shell, a standard VIRQ driver for game stuff (which is downward compatible with *King's Quest 3* and other games), dynamic resizing of text as well as graphics windows, and a real serial mouse driver. Unfortunately, there may not be enough room in the 64K system workspace to deliver resizeable text windows. We'll have to wait and see. The same goes for a mouse cursor on text windows.

After RAINBOWfest, I asked Kevin Darling if he knew anything about the mysterious Mona Lisa Project. As I feared, he could not confirm its existence; however, he did not discount it either. The present OS-9 Users Group president agreed that something with performance and feature improvements in every system module, with special emphasis on graphics, future expandibility and ease of programming for the newcomer would be very nice.

"If, for example, a BASIC09 program that uses pull-down menus could be written in a dozen lines versus the hundreds needed currently, then yes, that would indeed be a boon to OS-9 users. Also, if CoCo *Max*-like programs could be written by almost anyone using powerful new `gfx2` commands — or if `gfx2` commands were exceptionally faster — it would be fantastic.

"And come to think of it, named pipes would really enhance interprocess communications, wouldn't they?" Darling said. "They have been on my wish list since the first time I read about them in the first OSK catalog."

Skala thought the improved graphics speed he witnessed was certainly the most impressive and visible part of the Mona Lisa demo. He even suspected that the

---

Dale L. Puckett, a freelance writer and programmer, serves as director-at-large of the OS-9 Users Group and is a member of the Computer Press Association. His username on Delphi is DALEP*: on packet-radio,* KOHYD *@* N4QQ*; on GEnie,* D.PUCKETT2*; and on CIS,* 71446,736.

OS-9 Spotlight

This month we spotlight *UltiMusE III*, an amazing professional music synthesizer program sold by Second City Software and written for OS-9 by Michael J. Knudsen.

UltiMusE III was made practical by a number of OS-9's built-in features. "*UltiMusE III*'s major advantage over its competitor, *Lyra*, is its use of 640-by-192 high-resolution graphics screens," Knudsen said. "*UltiMusE III* also lets you declare a number of different staff types instead of just the grand piano. It supports sixteen voices compared to *Lyra*'s eight."

UltiMusE III also uses a different editing mode — you edit in Overstrike mode rather than Insert mode. *UltiMusE III*'s major advantage for the musician is the fact that it supports nearly all standard music notation.

If you already have a large collection of *Lyra* music, don't worry. Knudsen is working on a program that will convert *Lyra* files into *UltiMusE III* files and back. He also hopes to write a program that will play the standard MIDI file format. This will let you play MIDI music composed on *any* personal computer.

What OS-9 Did for *UltiMusE III*

First, OS-9 gave Knudsen an escape from the hard work it takes to write assembly language programs. "I thought *UltiMusE* would be too complicated in assembler and wanted to write it in C because I had plenty of experience with C," he said. "Since the only decent C compiler for the Color Computer runs under OS-9, the decision to use OS-9 was easy."

Soon after he began programming *UltiMusE III*, Knudsen discovered a surplus of features already built into OS-9, and he's used many of them. For example, he sets up the time each note plays on the synthesizer by using the OS-9 `sleep` command. Later he discovered this approach had a fringe benefit. "I set the process priority at 254 when *UltiMusE III* is playing, but because I use `sleep` calls, any other program running on the CoCo 3 at the same time gets all the time it needs," Knudsen said.

Other OS-9 features responsible for *UltiMusE III*'s success are pipes and the operating system's ability to run many processes concurrently. For example, when you buy *UltiMusE III* you will notice several additional programs in your `CMDS` directory. `Fran`, the first, is a specialized version of `grfdrv`.

"I just pipe the notes from *UltiMusE III* to `Fran` and it does all the screen work," Knudsen said. "There are two ways you can fight the 64K process space limit inherent in OS-9 implementations running on a 6809: You can use pipes to run a process in another 64K process space, or you can use automatic linking of subroutine modules."

Knudsen uses two subroutine modules: One is called `Show`, the other `Stave`. Both are loaded into memory when you run *UltiMusE III*, but they are only moved into its address space when needed.

Another big plus came to *UltiMusE III* users with Release 4.0 and higher. These versions use virtual memory for the score, meaning you can have up to 32,768 notes in a score. A score this size will use 256K of memory. Get/Put buffers containing the notes are loaded into memory, and your synthesizer continues to play without missing a beat.

Knudsen said that he could have used data modules to simulate virtual memory, but he decided to use the Get/Put buffers built into OS-9 Level II on the CoCo 3 instead. To do this he uses an invisible OS-9 Level II window to store the buffers when he brings them in off disk. This is ironic because the information he stores in the buffer has nothing whatsoever to do with graphics. In fact, *UltiMusE III* uses a VDG screen for all its displays. However, since you cannot use a Get/Put buffer with a VDG screen, the program opens a real window in the background to handle the musical notes.

There's not much difference between doing virtual memory with buffers or doing it with data modules. An *UltiMusE III* score is an array of objects of a special data type. Each element in the array is eight bytes long. When you play a song on your synthesizer, you are just sending out an array of these objects.

Each Get/Put buffer holds approximately 8000 bytes or 1020 notes. When Knudsen needs to address the *n*th note in the array, he divides *n* by 1020. The quotient is the index to the buffer — or page you need. The remainder is the offset into the page that points to the note itself.

When you run *UltiMusE III*, it creates one 8K buffer in the hidden window. If your score grows past 1000 notes, it creates a new buffer and starts to fill it. Knudsen uses the OS-9 map buffer function to write his data objects into the buffer's memory. He only maps in one page at a time. When he needs another page, he uses low-level software calls to switch the pages automatically. The switch happens so fast that you can't hear it when you're playing a score.

Knudsen uses an index to point to the note he is playing or editing. The fact that C is rich in its use of pointers made his job much easier.

When the routine returns, it may have switched in a new buffer, but the programmer doesn't need to know because the routine always returns with a pointer aimed at the note. This is one of the main reasons Knudsen used C instead of BASIC09 to write *UltiMusE III*.

The only real reason Knudsen didn't use data modules was the fact that you must have them on disk and load them into memory — even if they are empty initially. With the Get/Put buffers he didn't need to load anything from a disk. And because the Get/Put buffers are not resident in the 64K process space used by *UltiMusE III* until they are mapped in, they leave plenty of room for the rest of the program.

This approach also meant that Knudsen didn't need to do any dirty programming, like playing with the GIME chip directly or blocking the 6809's interrupts. Indeed, the only time *UltiMusE III* blocks interrupts is when it sends a character out the simulated serial port on the back of the CoCo 3.

If you're an OS-9 purist and want to avoid interrupts altogether, you can buy one of the hardware MIDI interfaces and write a device descriptor and device driver to handle its output with standard OS-9 calls. The *UltiMusE III* distribution disk contains a public domain descriptor and driver for a MIDI hardware interface, which you can use as a model. As supplied, it will drive the Speech Systems MIDI interface.

If you install a MIDI descriptor and driver, *UltiMusE III* will open a path to `/MIDI` and writes its music to it. The main advantage of a hardware interface is the fact that you can keep *UltiMusE III* operation pure OS-9.

In summary, *UltiMusE III* is the most advanced music editor you can buy for your Color Computer 3 — thanks to Mike Knudsen's skill and the power built into OS-9. Next month we hope to spotlight Eric Crichlow's *Shellmate*. I'm already playing with this new offering and it's slick. ❑

demo was running under BASIC09 — even though it was 10 times as fast as the same demo running under a stock version of OS-9 Level II. He suspected the code exercising OS-9's Get/Put buffers had been rewritten and optimized.

Mark Griffith also heard some interesting things at RAINBOWfest Somerset, but wasn't sure if they were related to Dennis's story. He said he heard that Bob Puppo, who designed and built the IBM Keyboard Adapter for the Color Computer, was working on a hardware modification that would boost OS-9's speed tremendously. He also mentioned Tony Distefano's 1-Meg memory upgrade board. We'll be keeping our eyes and ears open for new developements in these arenas.

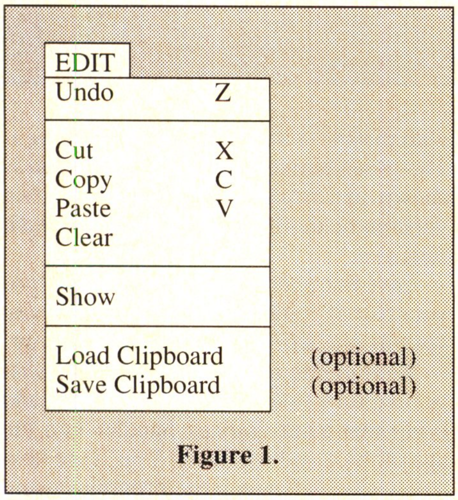


Figure 1.

Proposed Clipboard Standard

Our OS-9 Spotlight of Mike Haaland's *MVCanvas* in the January issue has already paid off. Haaland took many of our comments to heart and is using them in *MVCanvas Version 2.0*. He has proposed a clipboard standard based on our discussion. With his proposed standard, applications will use a clipboard to support all functions present on the Edit menu.

When you run a program using the proposed standard, you will first select the data you want to manipulate with tools supplied by the application program. Then you will select a command from the Edit menu shown in Figure 1.

Under the proposed standard, the Undo command will let you undo your last action. The Cut command will cut the text or graphics object you have selected from the document and place it on the clipboard. A Copy command replicates the selected object in your document and places it on the clipboard. Each time you copy or cut a new object, the new object will overwrite the present object on the clipboard.

The Paste command allows you to place data from the clipboard into your document at an insertion point you select with your mouse. When you paste, the data on the clipboard remains intact.

A Clear command clears everything on the clipboard. The Show command lets you see anything presently stored on the clipboard. If you exercise the Save Clipboard command, you will be saving the contents of the clipboard to a disk file. This command prompts you for a filename and then saves the clipped object. Effectively, you are creating a permanent scrapbook that contains one clipped object.

When you select the Load Clipboard command, your program searches the current working directory for a saved clipboard after prompting you for the name of the clip you want to load. If no clips are found, the program will put up a dialog box to let you know.

Any Edit functions needed by a program are appended to that program's menu. The menu entries followed by a letter indicate a hot key that may be pressed at any time while the application program is running. I

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published them here so we can develop a uniform standard set. The letter may be either upper or lower case.

Since most computers that use a clipboard do not keep a disk file to store clipboard data, Haaland proposed using Get/Put Buffers for the clipboard. Microware reserved a group of buffers specifically for the clipboard functions (Group 201) but it never defined the buffer numbers we should use. Haaland proposed the Get/Put buffer definitions shown in Figure 2.

If you select Save, application programs using this standard will take the selected data and write it to a file called `xxxxxx.CLP` in the current working directory. Type 01 through Type 04 clips will contain a one-byte Hex representation of the data type, followed by two bytes containing the length of the data and, finally, the data itself. For example:

```
01 0054 DATA[$54] [EOF]
```

Graphics Data uses the following format: A one-byte screen-type marker, a two-byte x length, a two-byte y length, and a two-byte total data length followed by the raw screen data. The following values are all in Hex. For example:

```
05 0010 0010 0020 DATA[$20][EOF]
```

So far, this standard is only a proposal. Any and all comments are encouraged. We need to establish some sort of standard or there will never be any compatibility between applications. It sure would be nice to have applications that can use the same data. Please send your thoughts to Mike Haaland. His CIS UID is 72300,1433. If you get a chance, send me a copy also — DALEP on Delphi or 71446,736 on CIS.

Here are the proposed Clip definitions:

01=ASCII
02=Binary
03=MIDI data
04=Sound Data
05=type 5 window (Buf) raw Graphics Data file
06=type 6 window (Buf) raw Graphics Data file
07=type 7 window (Buf) raw Graphics Data file
08=type 8 window (Buf) raw Graphics Data file
09-FF undefined

Turning Echo Off

Daniel L. Griffis of Tuscon, Arizona, wrote me recently to describe a technique he used to turn the OS-9 Echo function on and off from within a BASIC09 program. Griffis needed to turn off the Echo function so he could use the up arrow key in his program without clearing the screen.

You can accomplish this by running the OS-9 `shell` command from within BASIC09, but it's not the fastest way to get the job done. Griffis wrote a procedure that uses a system call to make things happen a lot faster. Since this procedure is short, it gives you an opportunity to lose your fear of system calls without a large investment in typing, etc. For comparison we'll start with the `shell` version shown in Listing 1. The procedure that uses the system call is shown in Listing 2. Combining the two versions results in `keys1` (Listing 3), which runs `eko`.

Give this short procedure a try and lose your fear of system calls forever. Once you see this one work, you'll be on your way.

Next month in RAINBOW's business issue we turn finance into *MVFinance* and bring that handy money handler into the age of mice and windows. You'll see how a new `gfx2` lets you write programs using OS-9 windows with a third of the program lines required in *MVShell.* I also hope to present the virtual memory subroutine code that makes *UltiMusE* work. It's a dream come true. In the OS-9 Spotlight, we hope to give you a close look at Eric Knudsen' s *ShellMate* — a program that helps make OS-9 file handling a snap.

❑

Editor's Note: The three listings presented are for reference only and will not be included on RAINBOW ON DISK.

Listing 1:

```
PROCEDURE keys
DIM a$: STRING[1]
PARAM g: BYTE
SHELL "tmode -echo"
REPEAT
  RUN inkey(a$)
UNTIL a$<>""
g=ASC(a$)
SHELL "tmode echo"
END
```

Listing 2:

```
PROCEDURE eko
TYPE registers=cc,a,b,dp:BYTE; x,y,u:INTEGER
DIM regs: registers
PARAM g: STRING[1]
DIM c(32):BYTE
regs.a:=0 \ regs.b:=0 \ regs.x:=ADDR(c)
RUN syscall($8D,regs)
IF g="-" THEN c(5)=0
  ELSE c(5)=1
ENDIF
regs.a:=0 \ regs.b:=0 \ regs.x:=ADDR(c)
RUN syscall($8E, regs)
END
```

Listing 3:

```
PROCEDURE keys1
DIM a$:STRING[1]
PARAM g:BYTE
RUN eko("-")
REPEAT
  RUN inkey(a$)
UNTIL a$<>""
g=ASC(a$)
RUN eko("+")
END
```

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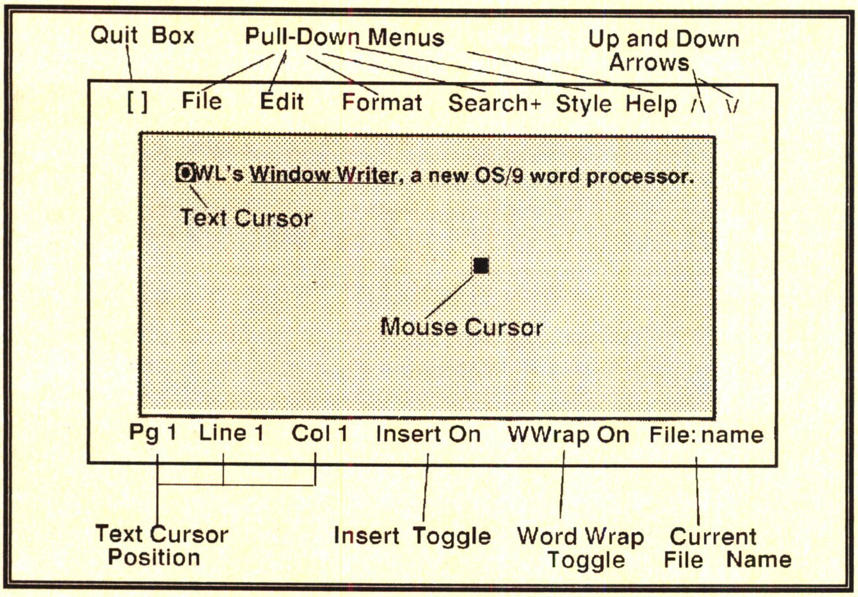

Multi-Tasks

Window Writer is the first Color Computer word processor which takes full advantage of OS/9. The result is a word processor which is fully as modern and professional in action as those previously available only for the IBM and Mac. The operating system allows true multi-tasking with other programs or itself. Not limited to just printing one file and editing another. You can print one file in one window while you edit files in other windows. At the same time you can be running a small program in another window. You can cut and paste between sections of files in different windows.

Hi-Res Display

Window Writer uses an **80-column monitor display** screen for clarity. As shown in the above screen drawing, you can quickly see how to access the menus and help screens. You can determine the current position by page, line number, and column. The mouse can use this section to quickly change to a specific page or line in the file. The text insert and word wrap toggles also are indicated and changeable with the mouse button.

Ram Disk

A RAM disk is set up in **Window Writer** to make full use of all or a user specified portion of the memory on the 512K CoCo 3. On the 128K CoCo a smaller RAM disk is set up to still allow use of all available memory for file editing. For use of all features, a 512K machine is required.

The RAM disk is used for storage of the file(s) being edited, for the clipboard for cut and paste, and as a print spooler for the file being printed. **Window Writer's** clipboard can be saved to disk or pasted into any file being edited because files use the same clipboard memory. The RAM disk also can be used with other OS/9 programs.

Mail-Merge

With **Window Writer** you can create form letters and send them out to a list of addresses in an address file. First names or other information can be added to "personalize" these letters.

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A full selection of pull down menus and detailed help screens make learning easy and are only a key stroke (or mouse click) away. All menus and help screens can be user configured for everything including menu colors and contents. You don't like the color of a menu? You think one help item should be listed differently? Change them!

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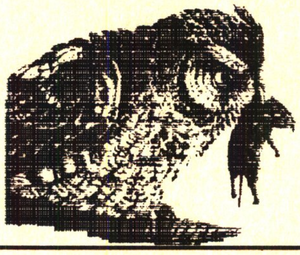

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New Uploads

by Greg Law
OS-9 SIGop

General Information (in the OS-9 SIG): **Kevin Darling** (OS9UGPRES) donated a file on the conjectured causes of the so-called BLOB (boot list order bug) that should be required reading for anyone creating new boot disks. **Dick White** (DICKWHITE) has archived the results of several polls, some of which asked about the differences between *JTerm* and *Telstar* and whether or not such items as *Print Shop* and *Lyra* would be popular items for OS-9. **Chris Burke** (COCOXT) is at it again with the most common questions and problems reported to Burke & Burke's technical support line.

Utilities: **Duane Penzien** (DUANO) posted a version of **Brian White**'s (BRIANWHITE) *DupFile* utility for OS-9 Level 1, and **Tony Schountz** (TONYSCHOUNTZ) provided sorting and formatting utilities.

Patches: **Mike Sweet** (DODGECOLT) furnished a patch to *OSTerm* that will allow it to use the serial port in the Disto 3-in-1 or 4-in-1 boards. **Raymond Mayeux** (RAYMAYEUX) came through with a short text file describing how to patch *Dynacalc* to set the number of printed lines per page, and Tony Schountz chipped in a patch for *Dynacalc* that allows you to put the `dynacalc.trm` file in `/DD/SYS`.

In addition to being OS-9 Online SIGop, Greg Law enjoys programming on all types of computers and has worked on systems ranging from the CoCo to the Burroughs B6700 super mainframe. He lives in Louisville, Kentucky.

Graphics & Music: **John Kou** (BAMBOO) is hereby nominated for this month's Database Overload award with no less than twenty Gospel arrangements for piano and organ in *UltiMusE 3* format including such favorites as "To God be the Glory", "All in the Name of Jesus" and "Peace in the Midst of the Storm." **Mike Schneider** (MSCHNEIDER) delivered three sound files containing classic quotes from Arnold Schwarzenegger movies. **Mike Ward** (MIKEWARD) kicked in a pair of utilities that will send or receive a dump of the 32 sounds that make up a DX-7 MIDI bank dump and even includes the source code. **Zack Sessions** (ZACKSESSIONS) handed out some VEF utilities written by Mike Haaland including a utility that compresses VEF graphics files by as much as 66 percent. Mike Sweet submitted a *Lunar Lander* type game that is compatible with *Multi-Vue*, and **Jim Buck** (COCOROGUE) donated an *UltiMuse* arrangement of "Put Your Hand in the Hand" as recorded by Anne Murray.

Programmers Den: **Mark Farrell** (XLIONX) provided two sieves including the traditional ten and 255 loop versions with the assembly language source code.

Tutorials & Education: **Timothy Martin** (TJMARTIN) contributed a simple spelling test program including the source code that uses the Speech and Sound Cartridge.

CoCo SIG

General Information: **Steve Bjork** (6809ER) presented the transcript of the October Game Conference.

CoCo 3 Graphics: **Richard Trasborg** (TRAS) chipped in more Rascan images that were digitized by Mike Trammell and two additional digitized images in the continuation of the Tennis series. **Christian Michaud** (SUPERCHRIS) furnished an image from the movie *2010: Space Odyssey 2*, and a majestic cobra in the desert. **Pete Ellison** (PETEELLISON) published a 4096 Rascan digitized image of a wild looking dragon created by Brian Rhoden. **Roger Hallman** (ROGERH) came through with several pictures converted from the Amiga.

Source for 6809 Assemblers: **Roger Krupski** (HARDWAREHACK) donated a mini-tutorial describing an assembly language programming technique that allows a program to store variables without using the direct page to avoid conflicts between the BASIC interpreter and your program.

Games: **John Malon** (JOHNLM) uploaded a trivia game using initials and numbers, and **Erik Swenson** (ERIKS) provided *Go Fish*, a popular card game for all ages.

Music & Sound: **Frances Calcraft** (FRANCALCRAFT) posted six musical arrangements for *Bells & Whistles 2* including "Red River Valley"," Toccata in D Minor," and "Russlan and Ludmilla Overture". **Mark Raphael** (MARKRAPHAEL) kicked in "Peter and the Wolf" for *Orchestra-90*.

Telecommunications: **Rick Adams** (RICKADAMS) contributed a file written by Eric Tilenius describing the CoCo mailing list and file server services he maintains for ARPAnet, Bitnet, and Usenet sites. Rick also bestowed *DELPHIterm Version 2.2* on an unsuspecting public with such features as automatic log-on, macros, built-in RAM Disk, Xmodem file transfer protocol, conference mode and an assortment of other goodies.

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Converting to CoCo

by Marty Goodman.

Contributing Editor

Is it possible to convert Tandy 1000 programs to my CoCo? If so, how do I convert them?

Carl Newman
Georgetown, Ontario

Most commercial Tandy 1000 programs (or MS-DOS programs in general) cannot be converted to the Color Computer unless you totally rewrite the program. This is because the programs are designed to run in MS-DOS (the CoCo cannot run MS-DOS) and because they are written for a totally different processor (the Intel 80X86-type processors, not the Motorola 6809 used in the CoCo). Programs written in BASIC using a standard 80-column text display with CGA-type graphics can often be converted for running on the Color Computer, but you have to be familiar with the differences between BASIC on the Color Computer and on MS-DOS machines.

Compiled *Quick BASIC* or other compiled BASIC programs on the Tandy 1000 cannot be converted unless you have access to the original source code. Even then, they will run slowly. Some programs written in C language for UNIX machines have been ported over to the Color Computer under OS-9. This kind of conversion should be done by an experienced C programmer familiar with both the original and target C environments.

Megahertz Speed Problem?

I have an old Tandy brand RS-232 Pak that I use with my Color Computer under OS-9. I've heard the 6551 ACIA chip in that Pak is rated for operation at only 1 MHz, not the 2-MHz speed of OS-9 Level II. Can this cause a problem?

James McDaniel
Brooklyn, New York

It is true that the 6551 chips used in the Tandy RS-232 Paks were rated for only 1-MHz operation. I've received only occasional reports from owners of older Tandy RS-232 Paks who had intermittent problems that were cured by replacing the 6551 with a 6551A rated at 2 MHz. It seems as if most of the 1-MHz-rated 6551 chips work acceptably at 2 MHz. However, it is equally clear from reports I have collected on the Delphi CoCo SIG that not all such chips can handle the speed. If you are having intermittent lock-ups or other problems while using the RS-232 Pak under OS-9, consider replacing the 6551 chip in the RS-232 Pak with a 6551A.

On some models of the RS-232 Pak from Tandy, the 6551 chip is soldered into the circuit board, so you'd need to be skilled in desoldering chips to accomplish the replacement and have on hand a 28-pin IC socket.

How to Start a Conversation

How can I talk to an Avatex 1200E modem from BASIC? Can I do this at 1200 baud? How does the Tandy Hi-Res Joystick Interface work, and how can I use it from BASIC?

Richard Ray
Richland, Mississippi

Past issues of THE RAINBOW hold the answers to both of your questions. A while back there were some articles by Dan Downard and others in which a machine language program was provided to allow BASIC programmers to use the 4-pin serial port on the CoCo to talk to a modem (November 1983, Page 118; November 1985, Page 106; November 1986, Page 70). I believe this software works only at 300 baud. The program was created to help CoCo owners write their own BBS programs in BASIC. To talk to the modem at higher speeds under BASIC, you need to use a hardware RS-232 Pak (currently sold by Orion and CRC/Disto).

Even with the RS-232 Pak, BASIC is so slow that in many applications it misses information sent by the RS-232 Pak. For many such modem applications, you need to use assembly language or compiled C. It is true, however, that some OS-9 terminal programs are written almost entirely in BASIC09.

RAINBOW published a series of articles by Steve Bjork in the July '86 through September '86 issues, providing some explanation of how the Hi-Res interface works. For more information, also see Bill Barden's column on Page 40 of the February 1990 issue.

New-Style Fried Multi-Pak Interface

I seem to have fried my new-style Multi-Pak Interface. When I plug the interface into my Color Computer 3, it causes the

---

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

computer to crash. How should I go about repairing it? I accidentally broke a wire of the Multi-Pak's upgrade, but I soldered it back into place.

Philip Brown
San Raphael, California

Often a single gate in one of the address or data buffer lines is zapped. You need to check with a logic probe or oscilloscope to see if one of the address or data lines on the Multi-Pak is stuck, and if so, replace the offending chip (a 74LS245 if a data line; or one of the many 74LS367s, if an address line). First check the power supply to the Multi-Pak to see that it is providing all the proper voltages. [Philip lives near me, so I invited him to bring his Multi-Pak over one afternoon. At that time I determined that its 5-volt power supply was defective (reading 2.5 volts or less). The first thing I checked was the protective Zener diode on that supply (D5). It turned out that D5 was fused (shorted). On removal of D5, a proper 5 volts was measured. So I replaced D5 with another, higher current-rated 6.2-volt Zener diode. The Pak still did not work. I then discovered Philip had soldered the broken wire to the wrong place. When the wire was connected properly, the Multi-Pak began to work again.]

Running ROM in RAM

Why can't I get the newer 32K ROM Paks to run in RAM using the techniques I've used for older Paks?

Frances Calcraft
Dawson Creek, British Columbia

Your problem could be the result of one of many reasons:

- 32K ROM Paks require special software to access all 32K and grab the data in them.

- At a minimum custom changes would be required in each program to allow a 128K or 512K CoCo 3 to emulate in RAM the kind of bank switching that is done with the 32K ROM.

- Many of the new ROM Paks are protected. That is, the author specifically wrote the code in such a way as to make it quite hard to run that code all in RAM.

- Some of the newest ROM Paks do not contain just a ROM. *Predator* from Activision and *Robocop* from Data East also contain two small-scale logic chips for bank select circuitry that operate using a port at $FF40. By writing into the first three or four bits of $FF40, you select which part of the ROM the computer can look at in eight- or 16K banks. Thus, to run those Paks in RAM, you have to decode the exact manner of the bank select circuitry and pull out all the data, then alter the bank select code in the pack to use RAM and the MMU of the CoCo.

Each customization has to be performed differently for each game. Use of this bank select circuitry is not necessarily an effort to prevent running the game in RAM. It is done to allow access to more ROM data (64K or more) than the CoCo 3 can access or to allow a CoCo 2 to access more than 16K of ROM.

Instructions and utilities are posted on Delphi describing how

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to put *Silpheed*, *Super Pitfall* and *Rad Warrior* onto disk and run them without the ROM Pak present. The fix for *Super Pitfall* requires a 512K CoCo because *Super Pitfall* uses all the 128K of RAM plus all of its 32K ROM Pak and so cannot be emulated in an all-RAM environment on a 128K CoCo.

What's the Best Drive Buy?

I'm about to buy a disk drive. What kind do you recommend? Can a program saved on a 35-track drive be read by an 80-track drive or vice versa?

Charles Rempel
Plum Coulee, Manitoba

Part 1 of a two-part article about floppy disk drives can be found on Page 22 of this issue of THE RAINBOW. It should answer most of your questions.

How Many Ports?

Is there any way to put a parallel port, an RS-232 port and a hard drive SCSI port inside my CoCo 3 and not use the cartridge slot?

Michael Trombley, Jr.
Ware, Massachusetts

Tandy Express Order carries a Disto Super Controller 2 that internally accepts a card supporting all three functions you mentioned plus a real-time clock. You plug the four-in-one card into the Super Controller, attach an external power supply, and then plug the Super Controller 2 into the CoCo cartridge slot.

The Eliminator, from Frank Hogg Laboratories, provides all of the functions you want under OS-9 when used with a special hard and floppy disk controller board.

Despite my frequent negative comments on the project, many RAINBOW readers have successfully packaged their CoCo 3s, controllers, hard drives and such inside IBM-style cases, especially baby AT-style cases using an IBM clone power supply. You have to be a competent hacker to do this, but many who have are quite pleased with the results. Some have actually packaged a Multi-Pak Interface inside the AT case, though most use Y cables to add all the functions they require. Such major custom projects are, of course, fraught with dangers of unreliable operation of the final product (due to subtle things such as ground loops or Y cable problems). Still, I've heard from many proud hackers who, despite all my warnings, succeeded in such elegant repackaging.

Working at Home While at Work

I have two Color Computers, one at work and one at home. While at work, I'd like to call home and access that computer as if I were at home. How can I do this?

Philip Unger
Standish, Wisconsin

Various programs have been developed under RS-DOS that offer some of what you ask. For a while Erik Gavriluk had in public domain a BBS program that allows you to access the disk drive of a remote computer. Practically speaking, it is usually impossible to run a complex program, especially one that uses Hi-Res graphics, from a remote Color Computer. But if you are using a bulletin board program, it is easy to call up a remote computer and access its disk drives and grab or save files using them.

Under OS-9 you can do more than this and actually run programs remotely. However, the bottleneck posed by the slow speed of even 2400-baud serial communication through a modem makes running some highly graphics-dependent programs difficult or impossible.

Text-only applications or those that use only text-type block graphics can be effectively run remotely under OS-9. The equivalent baud rate at which information can be transferred between the computer's memory and its graphics screen can, in some cases, be many millions of baud.

Crazy Over a Cable

I'm going crazy trying to make a null-modem cable enable me to transfer files between my Tandy 200 and my CoCo. Can you help?

Bill Jackson
Sacramento, California

I'm not surprised to hear you are having some difficulties. It took me a while to make up a proper null-modem cable to hook my Tandy 100 to my CoCo. You have to take care of needed handshaking. Here's the wiring that worked.

On the DB-25 male connector that hooks to the Tandy 200, connect Pin 4 to Pin 5, then hook pins 6, 8 and 20 together. With the DB-25 prepared in this fashion, make a cable that wires it to a 4-pin DIN connector (for the CoCo) as follows:

CoCo 4-pin DIN	M100/102/200 DB25
1	6,8,20
2	2
3	7
4	3

If you have one of the new Tandy WP2 portable word processors, you can try the following cable to hook its DB9 RS232 via Telcom to the CoCo's 4-pin DIN jack.

First short Pin 7 to Pin 8 of the DB9, and join pins 1, 6 and 4. Then make the cable as follows:

CoCo 4-pin DIN	WP2 DB9
1	6,1,4
2	3
3	5
4	2

Your technical questions are welcomed. Please address them to CoCo Consultations, THE RAINBOW, P. O. Box 385, Prospect, KY 40059.

We reserve the right to publish only questions of general interest and to edit for brevity and clarity. Due to the large volume of mail we receive, we are unable to answer letters individually.

Questions can also be sent to Marty through the Delphi CoCo SIG. From the CoCo SIG> prompt, pick Rainbow Magazine Services. Then at the RAINBOW> prompt , type ASK (for Ask the Experts) to arrive at the EXPERTS> prompt , where you can select the "CoCo Consultations" online form, which has complete instructions.

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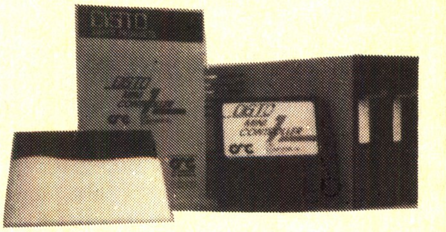

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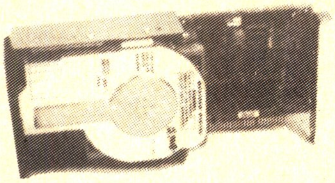

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Graphics Fairyland

by Joseph Kolar
Contributing Editor

Let's walk down the path that leads to magnificent graphics designs rotated around a point. There's a fairyland of incredible graphics wonders awaiting us.

By using the `DRAW` statement with an assist from the A option, we can draw a design unit that can be replicated three more times, with equal distances between each unit. The design units rotate around a central point. The first `A0` design may originate in any quadrant, lie on top of two adjoining quadrants, or encroach on all four.

Since the design units are clones, we need not overly concern ourselves with design units oriented, located and copied by `A1`, `A2` and `A3`.

Whatever design we dream up can set in a location with `A1`, `A2` and `A3` operating together to create a cohesive design. However chaotic your design is, you can produce remarkable and unexpected results.

The key to making these symmetrical works of art is the initial design. We need only to concentrate on the first design unit, regardless of what quadrant or quadrants it lies in. CoCo follows through using `A1`, `A2` and `A3` to complete the masterpiece.

It is exciting to be able to create high-quality designs easily. Usually I work up to a final, hopefully impressive, masterpiece. In this instance, I can't wait to show you what you can create, so let's look at the program in Listing 1.

Type in Listing 1 and run it a few times. Then dust off your graph paper and plot out the basic design in Line 101. You should check out each design to see its basic composition. Go slowly, savor every morsel of information and you will be astonished at CoCo's performance.

`PMODE4,1`, in either of the two `SCREEN`s available in lines 11 and 12, offers the best resolution and most interesting colors.

There is an alternate demo design at Line 100. It carries the same string variable name, `A$`, as does the one at Line 101. Unmask Line 100 and run the program. Nothing new! It did not need to be masked with `REM`. The computer searches through the list of variables and recognizes only the last one listed. This is in the event that the same variable is used inadvertently more than once. In other words, using the same variable more than once in a program is asking for trouble. To avoid confusion, Line 100 was masked to make it kosher. Naturally, to view the alternate design in Line 100, it must be unmasked. Line 101 must be put into mothballs, so the last `A$` variable read by the computer is the one at Line 100. `A$` is used extensively to save reprogramming and editing of program lines. Mask Line 101, then run the program.

Hidden from view is a third version of the two demo masterpieces. Ordinarily, the designs using `PMODE3` are too coarse to bother with. However, every once in a while chance creates an interesting effect.

To view the two `A$` demos, Edit Line 9 and press the spacebar until the cursor is under +. Press `2D` to delete `+1` and `X` to extend the line. Press the left arrow three times and press ENTER again.

Before you edited Line 9, if `T=2` it calls Line 11, if `T=3` it calls Line 12, or if `T=4` it calls Line 11. After editing, if `T=1` it calls Line 10; if `T=2` it calls Line 12, and if `T=3` it calls Line 11. Now run the program. Not too impressive, eh?

Mask Line 100 and unmask Line 101, then run the program a few times. I gave it the name Dust. Did you notice that `:GOTO100` (at the end of lines 10 and 11) by-passes any intervening screens? Line 12 doesn't require it. Why?

Restore Line 9 to its original condition as in Listing 1. Add masked cross-hairs you can use whenever you want by inserting the following in front of Line 102:

```
'DRAW"BM0,96R128NR128NU96D96":
```

To give you an idea how the design is created, List 220 through 260. This is a nested loop routine used to draw around a central point, 128,96, in option `D$`, size `B$`, design `A$`, in the default color `C1`. We want to use all four A options in sequence (Line 220). We will expand the design element in steps of four, beginning at `S4` through `S44`. In order to concatenate the A and S options in Line 240, find the numerical value of `S`, add it to `S`, and assign it a string variable name, `B$`. `D$` serves the same purpose for `A`.

Because the design element must be run through the various sizes first, it is the inner loop in the `A0` angle. Then it moves on clockwise 90 degrees and ditto until it places four design units on the screen.

There are other ways to get this job done.

The task of erasing the entire design is accomplished in lines 104 through 130. To suit my personal preference, the design units were removed counter-clockwise. `C4` was used in Line 120 to draw an invisible design to over-print the visible one — just in case, we might revert to a screen in `PMODE3,1`. In the two-color set, `C0`, `C2`, `C6` or `C8` also nudges the CoCo to use the background's invisible color. In a 4-color set, `C0`, `C4` or `C8` work fine.

I don't know why I made the On routine after the Off routine. Without too much sweat you can revise the program so it runs in a straightforward manner. The point to be stressed is not how the program is assembled, but that the results achieved are

---

Florida-based Joseph Kolar is a veteran writer and programmer who specializes in introducing beginners to the powers of the Color Computer.

acceptable. When you are in a creative frenzy, you are not apt to worry about the niceties of program line sequence or construction. Create first, revise and reorganize later.

Line 102 points to the On routine. Line 280 produces a viewing pause and directs CoCo to the Off routine. Line 299 gives a shorter pause after the design is erased, and Line 205 clears the screen and points to Line 9 to make a new random selection.

The hidden Line 270 is an alternate to Line 280. This line allows for a longer viewing period and then makes an instantaneous wipe-out.

Consider this change: Edit Line 230 so `S=2 TO 42`, then run the program. Upon erasing, the CoCo strips off the multicolored design, leaving a fairly attractive residue.

Edit Line 105 so `S=42 TO 2` and run the program. You get a disappearing act because the Off over-print is in exactly the same location as the On print. Remember to alter these two lines carefully. If you alter the On line, you may alter its appearance. It is best to play around with the Off line so you do not disturb the integrity of a design.

Another elegant variant is developed by editing Line 230 to read `FOR S=4 TO 44 STEP 8`. Then run the program. Next change Line 105 to read `FOR S=42 TO 2 STEP -8` and run the program. Restore lines 230 and 105 to their original state.

Thus far we have used 128,96 as the point around which a design revolves. If you change these coordinates to another pair (for example, 120,92), in both lines 250 and 120, nothing unexpected happens.

Edit Line 101 and press the space bar until the cursor is under the first `E`. Press `IBR` and `ENTER` and run the program. The result is a completely unexpected design in an unexpected location. Surprisingly, if we changed `B` to `N` in Line 101, it feels a little better, even if the design is slightly off-center.

At this point we are forced to investigate to see exactly where our design is located and why it changed.

First remove the `BR` from Line 101, then run the program. Repeat the experiment by inserting `BR` again. We are making sure to reproduce the same phenomena and not introduce an error instead. Looking at the graph paper sketch of the element shows that it is still located at 128,96. So, why did it change form so radically?

Let's insert `2` after `BR` (`BR2`) in Line 101. Then run the program and map it out on graph paper. This neat design is even larger.

To visualize what is happening, the design must be sketched on graph paper. Keep in mind that the point of origin is 128, 96, and the first movement in the element is a one-space move to the right, `R`. Your point of origin dot should be one space to the left from where the visible design begins. Copy

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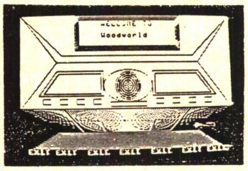

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the `A$` design and color it in red ink. Beginning at the dot that represents 128,96, make a design twice the size of the red one. A pencil sketch over the red one looks like this:

```
BR2E2F2R2E4F4G4H4L2G2H2
```

Do not confine yourself to the material we covered. Be resourceful — dig deep into the dark corners of your mind for ideas.

Remember, jump two spaces to the right before you begin drawing `E2`, etc. When you are finished and sure it is correct, color the pencil lines in red. You get an overlapping design.

Insert `GOTO 220` at the beginning of Line 102. Then insert Line 265, `GOTO 265`. Retype Line 230 to read:

```
230 FOR S=16 TO 32 STEP 16
```

This line makes two `A$` designs, one of them twice as large as the other. If you did your graph paper work correctly, it should mimic the screen display. Remember, `BR` is invisible. Now run the program.

Now change `BR` to `BR2` in Line 101. Do your paperwork in two sizes, as above. Your sketch and the display should be identical.

This verifies that the slightest change, even an apparently harmless change, drastically modifies the resulting design. This is great. With a minimum of alterations, you can produce a large number of variants — almost all of them unique.

While the program is set up in this experimental mode, change the jump direction in Line 101, one at a time, from `BR` to `BU`, `BL` and `BD`. Then run the program. Next try `BE`, `BF`, `BG` and `BH`. Note that the `U`, `D`, `L` and `R` directional jumps produce designs significantly different from those produced by diagonal jumps `E`, `F`, `G` and `H`.

Delete Line 265 and remove `B` from Line 101. Restore Line 230 as in Listing 1. Remove `GOTO 220` from the beginning of Line 102, if you want the cross-hairs. Otherwise leave it alone.

It seems as if it is impossible to not create a decent design. Even randomly chosen groups of directions create order out of a chaotic situation, when rotated around a point.

To illustrate the infinite number of designs possible, use either set, `E`, `F`, `G` and `H` or `U`, `D`, `L` and `R`. Using only one set, in any random order, make up an eight-unit line consisting of two each of the four directions in the set:

```
A$="EGHHFGEF"
A$="FEHGGEHF"
A$="DLDURRUL"
A$="DRLDULUR"
```

Place them, one at a time, into Line 101. Then run the program.

Combine the first two into one `A$` line and run the program. You might as well see what you get if you combine the last two! Run the program again. Now combine the second and third ones and run the program. Isn't it amazing to sit back and watch the CoCo work wonders, creating all sorts of unique shapes?

Now take one letter (direction) from `E`, `F`, `G`, `H`, `D`, `U`, `L`, or `R` and make up a nonsense word.

```
A$="FREGHDUL"
A$="REFDULGH"
A$="HULDFREG"
A$="GRUFHLED"
A$="DULFREGH"
A$="DULGHFER"
A$="FREGHULD"
```

Check them all out to see if they make anything worthwhile. Assign a number to each letter:

```
1 2 3 4 5 6 7 8
L R U D F G H E
```

(Not necessarily the above sequence). Choose an eight-digit number with non-repeating numbers. Substitute letters for the numbers:

```
63714482       GUHLDFER
23815674       RUELFGHD
23876451       RUEHGDFL
45163872       DFLGUEHR
```

Check out the above. I doubt, if in your wildest moment, you will dream up something like the last goodie. Remember, you saw it here first. Think of all the simple company logos you can invent.

Double that last mess, `DFLGUEHR` to `D2F2L2G2U2E2H2R2`. Put it in Line 101 and smoke it! There it is in its disgusting life-size ugliness. Now, I ask you, is that original or not? Who knows, maybe it is art. Maybe some burnt-out artist will pick up on one of your creations.

So much time was used in covering this A option, you'd think we exhausted the subject. Keep toying with Line 101 and create. Do not confine yourself to the material we covered. Be resourceful — dig deep into the dark corners of your mind for ideas.

To jog your memory, try this. Alphabetically, we have:

```
UDEFGHLR
RUDEFGHL
```

etcetera. No matter what far-fetched idea you initiate, something will develop.

To give you a final push, change Line 11 to `PMODE3,1:PCLS3:`, etc., and Line 12 to `PMODE3,1:PCLS2:`, etc. Experiment by changing colors in `PCLS` (1 through 8), to prove different color combos make the same designs appear dissimilar.

There are a lot of things left unsaid in this tutorial, so resign yourself to making it through one more A option tutorial. ❑

16K Extended

The Listing: DIAMONDS

```
0 'LISTING1
9 T=RND(3)+1: ON T GOTO10,11,12,
11
10 PMODE 3,1:PCLS:PMODE0,4:SCREE
N1,1:GOTO100
11 PMODE4,1:PCLS:SCREEN1,1:GOTO1
00
12 PMODE4,1:PCLS:SCREEN1,0
100 'A$="U4NHNEBD2R2D2"'ALTERNAT
E DESIGN
101 A$="EFRE2F2G2H2LGH"
102 GOTO 220
104 FOR A=3 TO 0 STEP-1
105 FOR S= 44 TO 4 STEP -4
110 B$="S"+STR$(S)
115 D$="A"+STR$(A)
120   DRAW "C4BM128,96"+D$+B$+A$
130 NEXT S,A
200 FOR Z= 1 TO 200:NEXT
205 PCLS:GOTO 9
220 FOR A= 0 TO 3
230 FOR S= 4 TO 44 STEP4
240 B$="S"+STR$(S):D$="A"+STR$(A
)
250 DRAW"BM128,96"+D$+B$+A$
260 NEXT S,A
270 'FOR Z= 1 TO 2000: NEXT:PCLS
:GOTO 9
280 FOR Z= 1 TO 600:NEXT:GOTO 10
4
```

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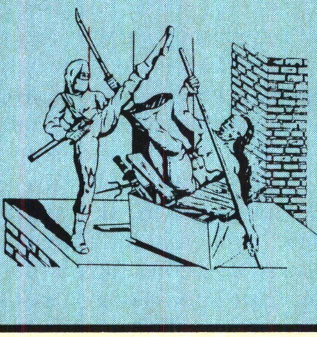

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Moon Mapper

by David Francis

A fascination with satellites that began thousands of moons ago

The first things I saw, using a 2½-inch refracting telescope, were the four largest satellites of Jupiter. These moons, often called the Galilean satellites (Galileo discovered them in 1610), are fascinating to watch as they swing around the largest planet, forming a miniature solar system with the dozen or so other smaller satellites of Jupiter. They become even more interesting when you realize that two of them, Ganymede and Callisto, are larger than our own moon (Ganymede being roughly the size of the planet Mercury) and that the innermost of the four, Io, is the only planet besides Earth known to have active volcanoes. The satellites aren't difficult to see; binoculars or any 2-inch telescope shows them easily. Of course, you have to know where Jupiter is in the sky; see the "Sky Almanac" section in the current issue of *Astronomy Magazine*. Table 1 (next page) lists the basic information on the Galilean satellites, along with that for Earth's moon for comparison.

The following programs help you track these planet-size moons. *Galisat* originally appeared in the June 1989 issue of *Sky & Telescope Magazine* and was written for the Apple II by Odilon Correa. I modified the program to run on the CoCo 2 (*Galisat2*) and CoCo 3 (*Galisat3*). An RGB monitor isn't necessary for *Galisat3*, but it gives a sharper display than a TV. Both these programs use the high-speed poke (Line 32), so you should either leave it out or deactivate that line with an apostrophe (`REM`) until you've typed in and saved the entire program. Disk I/O in the High-Speed mode can crash your directory.

CoCo 3 Version

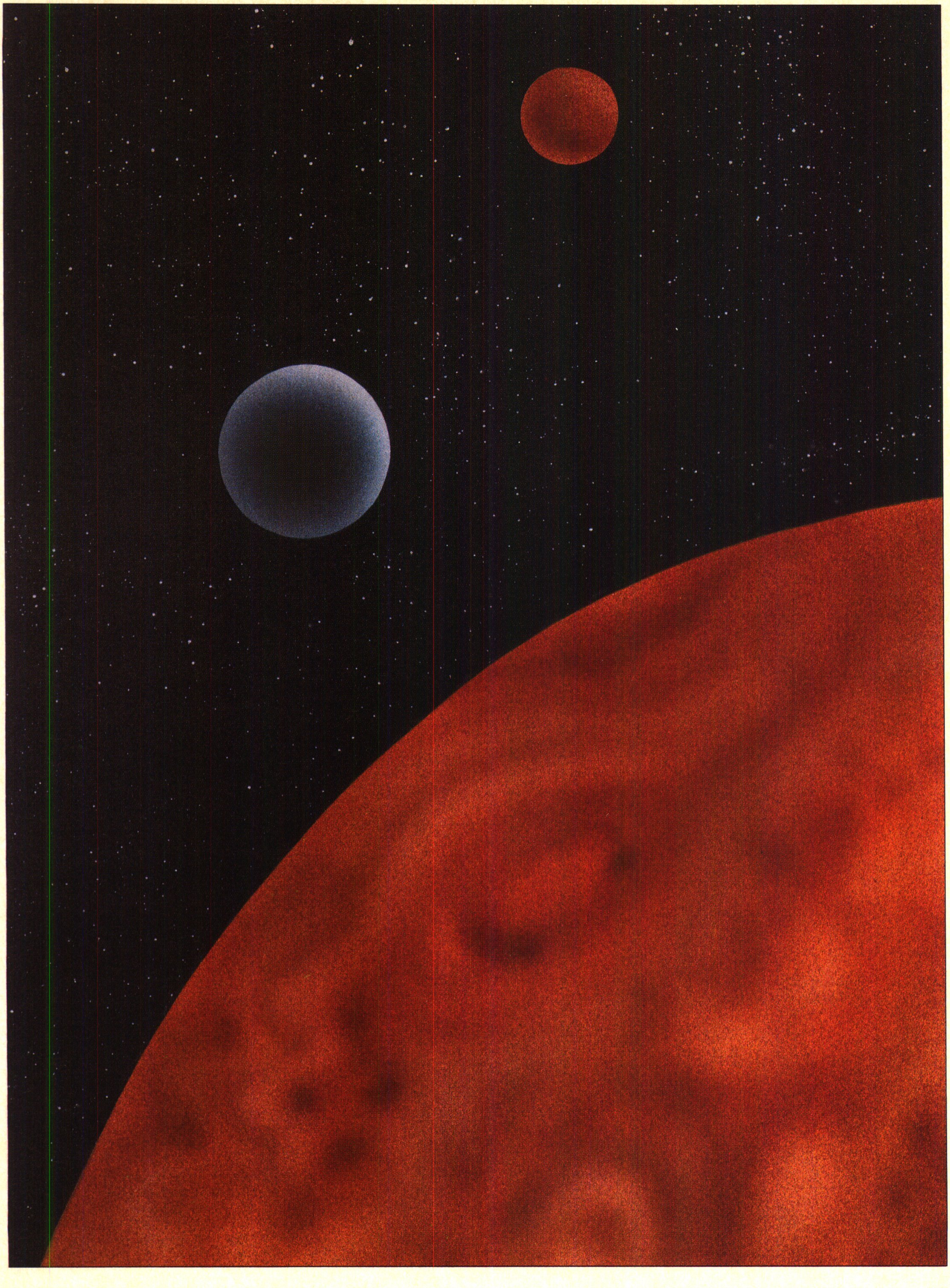
After you type in and run *Galisat3*, the title screen is displayed and the necessary variables are initialized. Then you are asked for the year, month and day on which you want the plot to begin. You may enter any date from January 1, of the year 1 to December 31, 99999. All entries must be numeric; if you want to start on January 1, 1990, you enter 1990, then 1 (for the month), then 1 again. Next the program goes to an `HSCREEN2` and sets up the necessary labels and markers. Using some rather complicated math tricks, the actual plots of the satellites begin.

The plot is in two parts: the main graph above and the smaller window at the bottom. Both give you the same basic information in different ways. The graph uses sine waves to plot the positions. To find the current configuration of the satellites relative to each other, hold a straightedge against the screen, lining it up with the dashes on either side of the screen. (This is where SHIFT-@ really comes in handy.) The dashes represent approximately midnight EST on each day listed; each new plot position represents roughly an hour of real time.

The window at the bottom is much more interesting and is a feature not included in the original program (or the CoCo 2 version presented here). It shows the satellites from the side as they actually appear in a telescope or binoculars. Be forewarned, though: The edge-on display can be hypnotic if you watch it long enough.

If you want, you can press CLEAR during

David Francis has worked with the Color Computer for over six years. He enjoys music, reading and programming. He can be contacted at 4205 Speedway No. 210, Austin, TX 78751.



The Galilean Satellites

	Diameter (miles)	Rotation period	Distance from planet (avg.) (miles)	Magnitude (brightness) (avg.)
Io	2,020	1d 18h 29m	256,473	5.5
Europa	1,790	3d 13h 18m	16,691	5.7
Ganymede	3,120	7d 4h 0m	664,470	5.1
Callisto	2,970	16d 18h 5m	1,167,480	6.3
Moon	2,159	7d 7h 43m	237,165	-9.5

the plot and enter a new start date. When the graph reaches the window at the bottom, the program pauses and waits for you to press `CLEAR`. Pressing `BREAK` ends the program.

CoCo 2 Version

If you have a CoCo 2, type in *Galisat2*. It works basically the same as *Galisat3*. Run it, then enter the starting date you want and it begins plotting the satellites' positions on a `PMODE4` screen. The only other things it shows are the vertical lines representing the disk of Jupiter, the dashes indicating successive dates, and the labels at bottom for east and west. You can still press `CLEAR` at any time during the plot to enter a new start date or `BREAK` to quit (be sure to `POKE 65494,0`).

Notes/Modifications

The standard plot in both programs has west to the left, east to the right. This is how things look in an astronomical telescope in the northern hemisphere. But if you want to use binoculars, for example, reverse the plot by changing Line 6002 to read `L=-1`. `L` can only be 1 or -1.

For *Galisat3*, I didn't include data statements to tell the program how many days each month has, so you may see a February 30th on the plot screen, depending on what date you select. You might alter the program to include a feature making the dates on the plot screen exact for each month of the year.

I didn't include the edge-on window feature in *Galisat2*. You can incorporate this feature by studying lines 1014 through 1018 and Line 5006 in *Galisat3*. The `HSET` positions for the upper graph plot are in `X1,V` through `X4,V` — one per satellite. Those for the window plot are in `X1,V1` through `X4,V1`. `V` begins at 0 (the top of the graphics screen) and is incremented in Line 1018. `V1` is always 180.

As an exercise, flip the plot as I described above; enter January 7, 1610 for the date; and compare the plots with Galileo's original drawings shown in Figure 1 (reproduced courtesy of *Sky & Telescope Magazine*). They were made in January of 1610 when the Galilean satellites were first discovered. ❑

Drawings by Galileo in 1610

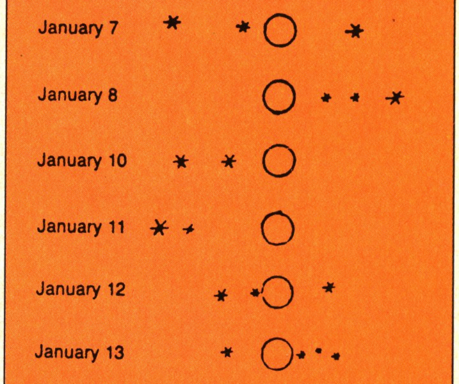


Figure 1

16K Extended

24	94
40	147
1008	192
1022	105
2016	234
3002	59
5000	100
5014	227
END	242

Listing 1: `GALISAT2`

```
0 ' COPYRIGHT 1989 FALSOFT, INC
2 ' ################################
4 ' #                              #
6 ' # GALISAT 2                    #
8 ' #                              #
10 '# COCO 2 VER. BY DAVID         #
12 '# FRANCIS. DEFAULT PLOT:       #
14 '# EAST=RIGHT, WEST=LEFT.       #
16 '# CHG. L TO -1 IN LINE         #
18 '# 6002 TO FLIP.               #
20 '#                              #
22 '################################
24 CLS:PRINTSTRING$(32,128):PRIN
T@11,"galisat";:POKE1043,50:PRIN
T@73,"COCO 2 VERSION":PRINTTAB(8
)"BY DAVID FRANCIS":PRINT:PRINT"
  PLOTS POSITIONS OF JUPITER'S
  GALILEAN SATELLITES
28 GOSUB6000 ' INITIALIZE
30 GOSUB2000 ' GET DATE
32 POKE65495,0
34 GOSUB5000 ' SETUP PLOT SCREEN
35 GOSUB1000 ' MAIN LOOP
36 ' ============================
38 ' MAIN PROGRAM LOOP
40 ' ============================
1000 DL=INT((N-INT(N))*20+.5)/20
:MT=(358.476+.9856003*N)*P:MJ=(2
25.328+.0830853*N)*P:JJ=221.647+
.9025179*N
1002 VT=1.92*SIN(MT)+.02*SIN(2*M
T):VJ=5.55*SIN(MJ)+.17*SIN(2*MJ)
: K=(JJ+VT-VJ)*P:DT=SQR(28.07-10
.406*COS(K))
1004 Z=SIN(K)/DT:I=ATN(Z/SQR(1-Z
*Z)):I=I/P:F=(N-DT/173):F1=I-VJ
1006 U1=84.5506+203.405863*F+F1:
U2=41.5015+101.2916323*F+F1:U3=1
09.9770+50.2345169*F+F1:U4=176.3
586+21.4879802*F+F1
1008 X1=5.906*SIN(U1*P+PI):X1=13
9+L*INT(X1*3.5+.5):X2=9.397*SIN(
U2*P+PI):X2=139+L*INT(X2*3.5+.5)
1010 X3=14.989*SIN(U3*P+PI):X3=1
39+L*INT(X3*3.5+.5):X4=26.364*SI
N(U4*P+PI):X4=139+L*INT(X4*3.5+.
5)
1012 IFINKEY$=CHR$(12) THENPOKE6
5494,0:RUN
1016 PSET(X1,V):PSET(X2,V):PSET(
X3,V):PSET(X4,V)
1018 V=V+1:N=N+.05:IFV=191 THEN1
020 ELSE1000
1020 IFINKEY$=CHR$(12) THENPOKE6
5494,0:RUN ELSE1020
1022 ' ========================
1024 ' GET DATE & CONVERT IT TO
1026 ' JULIAN DAY NO.
1028 ' ========================
2000 PRINT:INPUT" ENTER YEAR (YY
YY)";Y:INPUT" ENTER MONTH  (MM)"
;M:INPUT" ENTER DAY    (DD)";D
2002 GOSUB3000 ' DATE VALID?
2004 D=INT(D):G=1
2006 D1=INT(D):F=D-D1-.5
2008 J=-INT(7*(INT((M+9)/12)+Y)/
4)
2010 IF G=0 THEN2018
2012 S=SGN(M-9):A=ABS(M-9)
2014 J1=INT(Y+S*INT(A/7))
2016 J1=-INT((INT(J1/100)+1)*3/4
)
2018 J=J+INT(275*M/9)+D1+G*J1
2020 J=J+1721027+2*G+367*Y
2022 IF F>=0 THEN2026
2024 F=F+1:J=J-1
2026 N=J-2415020+F
2028 RETURN
2030 ' ========================
2032 ' CHECK FOR VALID DATE
2034 ' ========================
3000 IFY<0 OR Y>99999 THENPRINT:
PRINT" YEAR MUST BE 0 - 99999.":
```

```
GOTO3008
3002 IFD<1 OR D>31 THENPRINT:PRI
NT" DAY IS INVALID.":GOTO3008
3004 IF M<1 OR M>12 THENPRINT:PR
INT" MONTH IS INVALID.":GOTO3008
3006 RETURN
3008 PRINT:PRINT" PRESS [ENTER]
TO RE-ENTER DATA
3010 I$=INKEY$
3012 I$=INKEY$:IFI$="" THEN3012
3014 IFI$<>CHR$(13) THEN3012
3016 POKE65494,0:RUN
4002 ' ========================
4004 ' SETUP PLOT SCREEN
4006 ' ========================
5000 PMODE4,1:PCLS:SCREEN1,1
5001 IFL=1 THENDRAW"BM249,180"+E
AST$:DRAW"BM2,180"+WEST$ ELSEDRA
W"BM2,180"+EAST$:DRAW"BM249,180"
+WEST$
5002 LINE(136,0)-(136,191),PSET:
LINE(142,0)-(142,191),PSET
5004 FORZZ=2 TO 191 STEP20:LINE(
0,ZZ)-(15,ZZ),PSET:LINE(241,ZZ)-
(256,ZZ),PSET:NEXT
5012 RETURN
5014 ' ========================
5016 ' INITIALIZE
5018 ' ========================
6000 PI=3.14159265:P=PI/180:V=0:
V1=180
6002 L=1
6006 EAST$="U6R4L4D3R2L2D3R4":WE
ST$="U6D6E2U1D1F2U6
6008 RETURN
```

CoCo 3

24	69
40	56
1008	101
1018	117
2002	180
2026	176
3008	0
5002	193
5010	80
6002	152
END	127

Listing 2: GALISAT3

```
0 ' COPYRIGHT 1989 FALSOFT, INC
2 ' ################################
4 ' #                              #
6 ' # GALISAT 3                    #
8 ' #                              #
10 '# COCO 3 VER. BY DAVID         #
12 '# FRANCIS. DEFAULT PLOT:       #
14 '# EAST=RIGHT, WEST=LEFT.       #
16 '# CHG. L TO -1 IN LINE         #
18 '# 6002 TO FLIP.                #
20 '#                              #
22 '################################
24 PALETTE8,63:WIDTH40:CLS3:PRIN
TTAB(13)"* GALISAT  3 *":LOCATE1
3,2:PRINT"CoCo 3 Version":LOCATE
12,3:PRINT"by David Francis":LOC
ATE1,5:PRINT"Plots positions of
Jupiter's Galilean   satellites
26 ON BRK GOTO4000
28 GOSUB6000 ' INITIALIZE
30 GOSUB2000 ' GET DATE
32 POKE65497,0
34 GOSUB5000 ' SETUP PLOT SCREEN
35 GOSUB1000 ' MAIN LOOP
36 ' ==========================
38 ' MAIN PROGRAM LOOP
40 ' ==========================
1000 DL=INT((N-INT(N))*20+.5)/20
:MT=(358.476+.9856003*N)*P:MJ=(2
25.328+.0830853*N)*P:JJ=221.647+
.9025179*N
1002 VT=1.92*SIN(MT)+.02*SIN(2*M
T):VJ=5.55*SIN(MJ)+.17*SIN(2*MJ)
: K=(JJ+VT-VJ)*P:DT=SQR(28.07-10
.406*COS(K))
1004 Z=SIN(K)/DT:I=ATN(Z/SQR(1-Z
*Z)):I=I/P:F=(N-DT/173):F1=I-VJ
1006 U1=84.5506+203.405863*F+F1:
U2=41.5015+101.2916323*F+F1:U3=1
09.9770+50.2345169*F+F1:U4=176.3
586+21.4879802*F+F1
1008 X1=5.906*SIN(U1*P+PI):X1=13
9+L*INT(X1*3.5+.5):X2=9.397*SIN(
U2*P+PI):X2=139+L*INT(X2*3.5+.5)
1010 X3=14.989*SIN(U3*P+PI):X3=1
39+L*INT(X3*3.5+.5):X4=26.364*SI
N(U4*P+PI):X4=139+L*INT(X4*3.5+.
5)
1012 IFINKEY$=CHR$(12) THENHSCRE
EN0:POKE65496,0:RUN
1014 HSET(X1,V1,4):HSET(X2,V1,4)
:HSET(X3,V1,4):HSET(X4,V1,4)
1016 HSET(X1,V):HSET(X2,V):HSET(
X3,V):HSET(X4,V):FORII=1 TO 1000
:NEXT
1018 HSET(X1,V1,2):HSET(X2,V1,2)
:HSET(X3,V1,2):HSET(X4,V1,2):HLI
NE(137,180)-(142,180),PSET:V=V+1
:N=N+.05:IFV=170 THEN1020 ELSE10
00
1020 IFINKEY$=CHR$(12) THENPOKE6
5496,0:RUN ELSE1020
1022 ' ========================
1024 ' GET DATE & CONVERT IT TO
1026 ' JULIAN DAY NO.
1028 ' ========================
2000 LOCATE1,10:INPUT" Enter YEA
R (YYYY)";Y:INPUT"  Enter MONTH
 (MM)";M:INPUT"  Enter DAY    (D
D)";D
2002 GOSUB3000 ' DATE VALID?
2004 D=INT(D):G=1
2006 D1=INT(D):F=D-D1-.5
2008 J=-INT(7*(INT((M+9)/12)+Y)/
4)
2010 IF G=0 THEN2018
2012 S=SGN(M-9):A=ABS(M-9)
2014 J1=INT(Y+S*INT(A/7))
2016 J1=-INT((INT(J1/100)+1)*3/4
)
2018 J=J+INT(275*M/9)+D1+G*J1
2020 J=J+1721027+2*G+367*Y
2022 IF F>=0 THEN2026
2024 F=F+1:J=J-1
2026 N=J-2415020+F:DATE$=MONTH$(
M)+STR$(D)+",":DAY=D
2028 RETURN
2030 ' ========================
2032 ' CHECK FOR VALID DATE
2034 ' ========================
3000 IFY<0 OR Y>99999 THENPRINT:
PRINT" YEAR must be 0 - 99999.":
GOTO3008
3002 IFD<1 OR D>31 THENPRINT:PRI
NT" DAY is invalid.":GOTO3008
3004 IF M<1 OR M>12 THENPRINT:PR
INT" MONTH is invalid.":GOTO3008
3006 RETURN
3008 PRINT:PRINT" Press [ENTER]
to re-enter data.
3010 I$=INKEY$
3012 I$=INKEY$:IFI$="" THEN3012
3014 IFI$<>CHR$(13) THEN3012
3016 POKE65496,0:RUN
3018 ' ========================
3020 ' END
3022 ' ========================
4000 RGB:WIDTH32:POKE65496,0:END
4002 ' ========================
4004 ' SETUP PLOT SCREEN
4006 ' ========================
5000 HSCREEN2:HCOLOR4:HLINE(250,
0)-(320,191),PSET,BF
5002 HLINE(136,0)-(136,170),PSET
:HLINE(142,0)-(142,170),PSET
5004 FORZZ=2 TO 170 STEP20:HLINE
(0,ZZ)-(15,ZZ),PSET:HLINE(235,ZZ
)-(250,ZZ),PSET:NEXT:FORZZ=0 TO
23STEP5:HPRINT(1,ZZ),DAY:DAY=DAY
+2:IFDAY>30 THEN5006 ELSENEXT
5006 HDRAW"BM139,180BU2R2F1D2G1L
3H1U2E1":HPAINT(139,180):HLINE(0
,170)-(250,170),PSET:HPRINT(0,23
),L$:HPRINT(27,23),R$
5008 HCOLOR2:HPRINT(32,1),"Plot"
:HPRINT(32,2),"begins":HPRINT(32
,3),"on":HPRINT(32,4),MONTH$(M):
HPRINT(31,5),STR$(D)+",":HPRINT(
31,6),STR$(Y)+"."
5010 HPRINT(32,9),"Dashes":HPRIN
T(32,10),"indicate":HPRINT(32,11
),"midnight":HPRINT(32,12),"EST
on":HPRINT(32,13),"dates":HPRINT
(32,14),"shown.
5012 HPRINT(32,18),"[CLEAR]=":HP
RINT(32,19),"New Plot":HPRINT(32
,21),"[BREAK]=":HPRINT(32,22),"E
nd":HCOLOR4:RETURN
5014 ' ========================
5016 ' INITIALIZE
5018 ' ========================
6000 PALETTE0,9:DIMMONTH$(12):FO
RQ=1 TO 12:READMONTH$(Q):NEXT:PI
=3.14159265:P=PI/180:V=0:V1=180
6002 L=1
6004 IFL=1 THENL$="WEST":R$="EAS
T" ELSEL$="EAST":R$="WEST
6006 RETURN
6008 ' ========================
6010 ' DATA FOR MONTHS
6012 ' ========================
7000 DATA January,February,March
,April,May,June,July,August,Sept
.,October,November,December
```

A program that chunks down text for your word processor

Do the Split

by Stephen B. Goldberg

The first draft of a manual I was writing ended up a little more than 130K in length, which is larger than my word processor can comfortably digest at one time. I needed less text to edit. Then I remembered a UNIX utility called *Split*, which splits a large text file into multiple smaller files that are easier to handle. The syntax is:

```
split -n infile outname
```

Split reads *infile* and writes it in *n* line pieces (defaults to 250 lines if the `-n` option is omitted) to a set of output files. The name of the first output file is *outname*, with the extension `.aa` appended (*outname*`.aa`). The extension is then incremented alphabetically for each succeeding output file up to `.zz` (a maximum of 676 files).

Both *infile* and *outname* can be filenames or complete pathlists, and the output name can be no longer than 26 characters. Following are some examples of how you might use *Split*. At the OS-9 prompt type:

```
split -100 bigfile small
```

Split reads `bigfile` and sends 100 lines to a file `small.aa`. The next 100 lines goes to `small.ab` etc., until the entire text of `bigfile` is distributed to the smaller files. If no output filename is given, the default output name `X` is used. At the OS-9 prompt type:

```
split bigfile
```

Split reads `bigfile`, and the output filenames are `x.aa` through `x.zz`. Since no count appears, the default of 250 lines are sent to each of the smaller files. If a hyphen (-) replaces the input filename, then the standard input path is used. At the OS-9 prompt type:

```
list bigfile ! split -200 - text
```

Split accepts data from a pipeline because a hyphen is used in place of the input filename, telling *Split* to read the standard input path. The smaller files are named `text.aa` through `text.zz`, and each contains 200 lines. If no filenames are given, the standard input and the default output name `x` is used. At the OS-9 prompt type:

```
split <bigfile
```

In this case, `bigfile` is redirected to *Split*'s standard input because no names are given. Output filenames default to `x` with an extension and contain a default of 250 lines each.

I've included *MakeSplit*, a BASIC09 procedure that generates the *Split* module in the `CMDS` directory for Level II users without an assembler.

You may not need *Split* often, but it's a comfort to have on those occasions when your words run longer than your word processor can handle. ❑

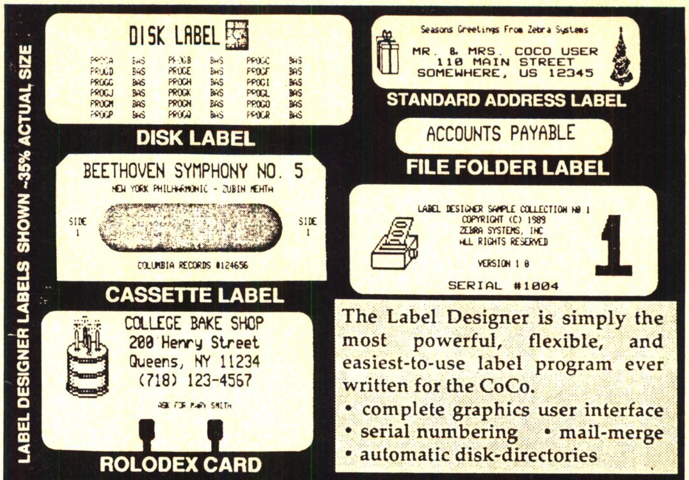
Steve Goldberg is a dentist who enjoys programming on his son's CoCo. He may be contacted at 695 Plainview Road, Bethpage, NY 11714. Please include an SASE when requesting a reply.

OS-9

Listing 1: `split`

```
**************************************************
*
* SPLIT  -  (c)1989 STEPHEN B. GOLDBERG
*
* Use: split [-n] [file [name]]
*
         ifp1
         use    /d0/defs/os9defs
         endc
*
         mod    len,name,prgrm+objct,reent+1,entry,dsiz
```

```
*
inpath   rmb  1          input path number
outpath  rmb  1          output path number
fpoint   rmb  2          filename pointer
count    rmb  2          line count
counter  rmb  2          line counter
ext      rmb  2          extension address
outname  rmb  100        destination name buffer
buffer   rmb  512        line buffer
         rmb  200        stack
         rmb  200        parameters
dsiz     equ  .
*
name     fcs  /Split/
         fcb  1          edition number
         fcc  /(c)1989 S.B.Goldberg/
******************************
* DECIMAL NUMBER TO BINARY
******************************
bin      ldd  ,x         parameter characters
         cmpa #'-        number option?
         bne  back       no, return
         cmpb #$20       number option?
         bls  back       no, return
         leax 1,x        bump pointer
         bsr  convert    convert digit
         bsr  bin2       convert 2 digits
bin2     bsr  convert    convert last 2 digits
convert  clra            zero msb
         ldb  ,x         get character
         subb #'0        make binary
         cmpb #9         valid digit?
         bhi  back       no, return
         pshs d          save it
         ldd  count      get previous total
         aslb            multiply by 10
         rola
         aslb
         rola
         aslb
         rola
         addd count
         addd count
         addd ,s++       add current digit
         std  count      save total
         leax 1,x        bump pointer
back     rts             return
******************************
* INITIALIZE
******************************
ex       fcc  /x /       default filename 'x'
*
entry    clr  count      zero line count
         clr  1+count
         clr  inpath     standard input path
         bsr  bin        make line count binary
findname lda  ,x+        parameter character
         cmpa #$20       parameter?
         beq  findname   not yet, look some more
         leax -1,x       source name pointer
         stx  fpoint     save pointer
skipname lda  ,x+        parameter character
         cmpa #$20       part of source name?
         bhi  skipname   yes, look some more
         ldb  #$0d       carriage return
         stb  -1,x       to end of source name
         bra  checkout   check for output name
findout  lda  ,x+        parameter character
checkout cmpa #$20       space?
         beq  findout    yes, skip it
         blo  xdest      no output name, use 'x'
```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DISK LABEL
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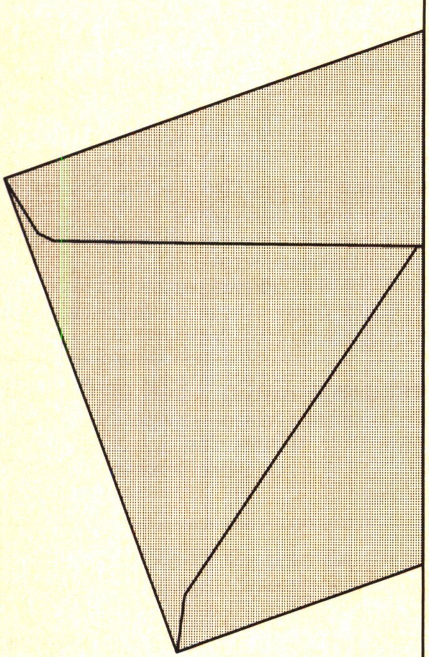

```
          leax -1,x        point to output name
          bra  makedest    make destination filename
xdest     leax <ex,pcr     default output name
makedest  leay outname,u   destination buffer
move      ldd  ,x+         output name character
          sta  ,y+         to buffer
          cmpb #$20        end of output name name?
          bhi  move        no, move another character
          lda  #'.         period
          sta  ,y+         to buffer
          sty  ext         save extension address
          ldd  #$6161      'aa' as extension
          std  ,y++        to buffer
          lda  #$0d        carriage return
          sta  ,y          to end of destination name
******************************
* OPEN INPUT FILE PATH
******************************
          ldx  fpoint      input filename address
          ldd  ,x          filename characters
          cmpa #$0d        filename?
          beq  create      no, use standard input
          cmpa #'-         standard input path?
          bne  open        no, open file
          cmpb #$20        standard input?
          bls  create      yes, continue
open      lda  #read.      read mode
          os9  i$open      open input file
          bcs  cantopen    prompt and quit with error
          sta  inpath      save input path number
******************************
* CREATE OUTPUT FILE(S)
******************************
create    leax outname,u   output filename
          stx  fpoint      save address for error
          ldb  #$0b        attr pr w r
          lda  #write.     write mode
          os9  i$create    create output file
          bcs  cantopen    prompt and quit with error
          sta  outpath     save output path number
******************************
* MOVE LINES TO OUTPUT FILE
******************************
          ldd  count       get count
          bne  savcount    any count?
          ldd  #250        no, make it 250
savcount  std  counter     put in counter buffer
lineloop  lda  inpath      input path number
          leax buffer,u    line buffer
          ldy  #512        maximum input length
          os9  i$readln    get line
          bcs  error       go on error
          lda  outpath     output path number
          os9  i$writln    write line to output file
          bcs  out         exit with error
          ldx  counter     get current line count
          leax -1,x        count = count-1
          stx  counter     done?
          bne  lineloop    no, move another line
******************************
* GENERATE NEXT OUTPUT NAME
******************************
          lda  outpath     output path number
          os9  i$close     close output path
          lda  inpath      input path number
          ldb  #ss.eof     end of file function
          os9  i$getstt    end of file?
          bcs  error       quit if end of input file
          ldx  ext         extension address
          ldd  ,x          get extension
          incb             increment last letter
          cmpb #'z         more than 'z'?
          bls  savit       no, save extension
          ldb    #'a          yes, make it 'a'
          inca                increment first letter
savit     std    ,x           save new extension
          bra    create       create next output file
********************************
* ERROR HANDLING ROUTINES
********************************
error     cmpb   #e$eof       end of file?
          bne    out          no, exit with other error
          clrb                clear error flag
out       os9    f$exit       quit
*
cantopen  leax   <cant,pcr    can't open message
          ldy    #cantlen     length of message
          lda    #2           standard error path
          os9    i$writln     message to screen
          bcs    out          exit with error
          ldx    fpoint       filename address
          ldy    #100         maximum filename length
          os9    i$writln     filename to screen
          bra    out          exit with error
*
cant      fcc    /**** Can't open: /
          fcb    7            bell
cantlen   equ    *-cant
*
          emod
len       equ    *
          end
```

Listing 2: `makesplit`

```
PROCEDURE MakeSplit
 0000       (* Creates Binary Module Split *)
 0021       DIM path,byt:BYTE
 002C       DIM count:INTEGER
 0033       CREATE #path,"/dd/cmds/split":WRITE
 004C       FOR count=1 TO 322
 005D         READ byt
 0062         PUT #path,byt
 006C       NEXT count
 0077       CLOSE #path
 007D       SHELL "attr /dd/cmds/split e pe"
 0099       END
 009B       DATA 135,205,1,66,0,13,17,129,107,0,89,3,254,83,112
 00CC       DATA 108,105,244,1,40,99,41,49,57,56,57,32,83,46,66
 00FD      DATA 46,71,111,108,100,98,101,114,103,236,132,129,45,38,41
 012E       DATA 193,32,35,37,48,1,141,4,141,0,141,0,79,230,132
 015F       DATA 192,48,193,9,34,20,52,6,220,4,88,73,88,73,88
 0190       DATA 73,211,4,211,4,227,225,221,4,48,1,57,120,32,15
 01C1       DATA 4,15,5,15,0,141,198,166,128,129,32,39,250,48,31
 01F2       DATA 159,2,166,128,129,32,34,250,198,13,231,31,32,2,166
 0223       DATA 128,129,32,39,250,37,4,48,31,32,3,48,140,209,49
 0254     DATA 74,236,128,167,160,193,32,34,248,134,46,167,160,16,159
 0285       DATA 8,204,97,97,237,161,134,13,167,164,158,2,236,132,129
 02B6       DATA 13,39,17,129,45,38,4,193,32,35,9,134,1,16,63
 02E7       DATA 132,37,93,151,0,48,74,159,2,198,11,134,2,16,63
 0318       DATA 131,37,78,151,1,220,4,38,3,204,0,250,221,6,150
 0349       DATA 0,48,200,110,16,142,2,0,16,63,139,37,45,150,1
 037A       DATA 16,63,140,37,43,158,6,48,31,159,6,38,227,150,1
 03AB       DATA 16,63,143,150,0,198,6,16,63,141,37,16,158,8,236
 03DC       DATA 132,92,193,122,35,3,198,97,76,237,132,32,173,193,211
 040D       DATA 38,1,95,16,63,6,48,140,22,16,142,0,18,134,2
 043E       DATA 16,63,140,37,239,158,2,16,142,0,100,16,63,140,32
 046F       DATA 228,42,42,42,42,32,67,97,110,39,116,32,111,112,101
 04A0       DATA 110,58,32,7,125,149,73
```

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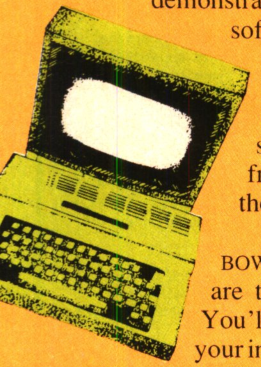
RAINBOWfest is a **great opportunity** for commercial programmers **to show off new and innovative products** for **the first time. Chicago, Illinois is the show** to get information on capabilities for the CoCo, along with a terrific selection of the latest CoCo software. In exhibit after exhibit, there will be demonstrations, opportunities to experiment with software and hardware, and special RAINBOWfest prices.



Set your own pace between visiting exhibits and attending the valuable, free seminars on all aspects of your CoCo — from improving BASIC skills to working with the sophisticated OS-9 operating system.

Many people who write for THE RAINBOW — as well as those who are written about — are there to meet you and answer questions. You'll also meet lots of other people who share your interest in the Color Computer. It's a person-to-person event and a tremendous learning experience in a fun and relaxed atmosphere.

As an additional treat for CoCo Kids of all ages, we've invited frisky feline CoCo Cat to join us for the show. RAINBOWfest has something for everyone in the family!

If you missed the fun at our last RAINBOWfest in Somerset, New Jersey, why don't you make plans now to join us in Chicago, Illinois? For members of the family who don't share your affinity for CoCo, there are many other attractions in the Chicago area.

The The Hyatt Regency Woodfield — Schaumburg, Illinois, offers special rates for RAINBOWfest. **The show opens Friday evening** with a session from 7 p.m. to 10 p.m. It's a daytime show Saturday — The CoCo Community Breakfast (separate ticket required) is at 8 a.m., then the exhibit hall opens promptly at 10 a.m. and runs until 6 p.m. On Sunday, the exhibit hall opens at 11 a.m. and closes at 3 p.m.

Tickets for RAINBOWfest may be obtained directly from THE RAINBOW. We'll also send you a reservation form so you can get a special room rate.

The POSH way to go. You can have your travel arrangements and hotel reservations handled through RAINBOW affiliate, POSH Travel Assistance, Inc., of Louisville. For the same POSH treatment many of our exhibitors enjoy, call POSH at (502) 893-3311. All POSH services are available at no charge to RAINBOWfest attendees.

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Game Programming Forum

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BASIC09

COCO COMMUNITY BREAKFAST

Frank Hogg — Key Note Speaker

Frank Hogg, entrepreneur, gives us insight into the future as we move progressively towards the 680x0 and OS9/68K. Frank's background, known well to RAINBOW readers, covers all the computers from the old WWTPC 6800 thru the CoCos to the 68030 based multi-megabyte QT computers he makes today. Frank's talk explores ways to bridge from the CoCo to the 680x0 computers with OS9/68000. He explores ways to run CoCo applications on OS9/68000 and the exciting possibility of running both a 6809 and 68000 in the same machine. Join Frank for this glimpse into the future.

Don't forget ...

If yours **is** one of the first 500 ticket orders, a coupon for a complimentary issue of The Third Rainbow Book of Adventures will be enclosed with your tickets — if yours is one of the first five orders received from your state, a coupon for a complimentary RAINBOWfest T-shirt will be enclosed with your tickets. So hurry up and place your order to take advantage of this offer.

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RAINBOWfest - Chicago, Illinois
Dates - April 6-8, 1990
Hotel - Hyatt Regency Woodfield
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Advanced Ticket Deadline: March 23,1990

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Tentative Schedule
RAINBOWfest - Somerset, New Jersey
Dates - October 20-22, 1989

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Make checks payable to: THE RAINBOW. Mail to: RAINBOWfest, The Falsoft Building, 9509 U.S. Highway 42, P.O. Box 385, Prospect, KY 40059. To make reservations by phone, in Kentucky call (502) 228-4492, or outside Kentucky call (800) 847-0309.

A quick lesson in trigonometry and Color Computer graphics

A Perfect Star

by Steven Ostrom

A problem presented itself the other day when I wanted to display a perfect five-pointed star on the Color Computer's high-resolution screen. It seemed like an easy task until my lack of artistic ability proved differently. The problem involved trying to figure out where the star's five points should be located. Connecting the points to make a star would be easy because of Extended Color BASIC's `LINE` function.

I knew the five points would all lie on a circle, so I drew a rough sketch (Figure 1).

Since there are 360 degrees in a circle and five points on the star, each point had to be 360/5=72 degrees apart. My old trigonometry textbook tells me I can find the coordinates of any point on a circle by the following equations: x=r*cos(A) and y=r*sin(A) where r is the radius of the circle and A is the angle formed between the positive x axis and the line drawn from the center of the circle to the unknown point on the circle (Figure 2).

If we want to draw a large circle on the high-resolution screen, we'll set r=95. Figure 3 shows a sketch of the points of the star on a circle with a radius of 95 (Figure 3). Each point has been labeled.

In this coordinate system the center of the circle is at point (0,0); no distance along the x axis and no distance along the y axis. You can see that Point 1 ($x1$,$y1$) is at the top of the circle and one quarter of the way around the circle (90 degrees around). The equations for this point are then:

$x1$=95*cos(90), $y1$=95*sin(90)

The second point is 72 degrees further around the circle, so its equations are:

$x2$=95*cos(90+72), $y2$=95*sin(90+72)
or
$x2$=95*cos(162), $y2$=95*sin(162)

Following this same logic we can write the equations for the other three points.

These five pairs of equations give us all five points perfectly placed around the circle.

Steve Ostrom has been programming for 22 years. He has written and published utilities, games and tutorials for the Color Computer. He may be contacted at 12612 Cedar Lake Road, Minnetonka, MN 55343. Please enclose an SASE when requesting a reply.

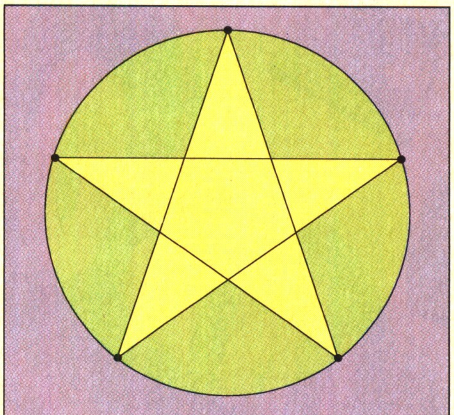

Figure 1

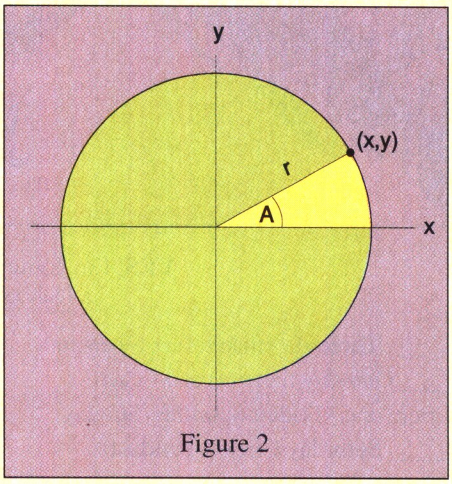

Figure 2

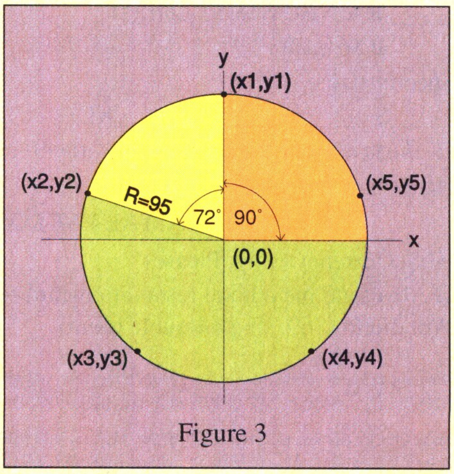

Figure 3

Color Computer Software

Window Master V3.0

Now you can have a User Friendly Point and Click operating system for your CoCo III with Windows, Icons, Buttons, Pull-Down Menus, Edit Fields and Mouse Functions built into your Basic or Machine Language Programs easily and quickly, without the need for OS9.

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CBASIC is the only fully integrated Basic Compiler and Program Editing System available for the Color Computer. It will allow you to take full advantage of all the capabilities available in your CoCo without having to spend years trying to learn assembly language programming. CBASIC allows you to create, edit and convert programs from a language you are already familiar with Enhanced Disk Color Basic, into fast efficient machine language programs easily and quickly.

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The SOURCE will allow you to easily & quickly Disassemble Color Computer machine language programs Directly from Disk and generate beautiful, Assembler Source code.

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- Allows specifying FCB, FDB and FCC areas.
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- Automatically locates address.
- Output listings to the Printer, Screen or both.
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- Full Screen line editing .
- Easy to use Single key editing commands.
- Load & Save standard ASCII formatted files.
- Block Move & Copy, Insert, Delete, Overtype.
- Create and Edit files larger than memory.

The Assembler features include:

- Supports Conditional IF/THEN/ELSE assembly.
- Supports Disk Library file up to 9 levels deep.
- Supports standard Motorola directives.
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- Allows assembly from the Buffer, Disk or both.

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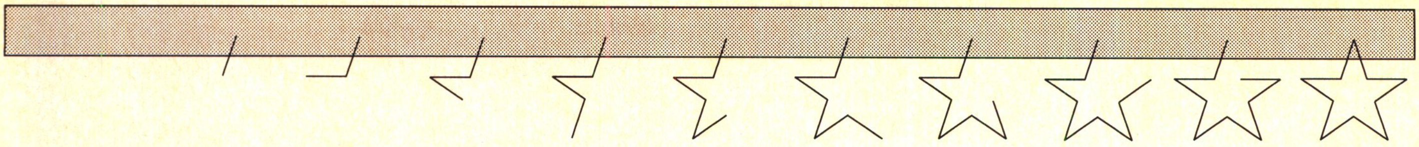

Since we want to draw the circle and star in the center of the graphics screen, the center of the circle is at Point (128,96) instead of at Point (0,0) on a normal *x*,*y* axis. This means that all of our points have to be moved. We'll have to add 128 to all *x* values and 96 to all *y* values if we want the center to be at (128,96) instead of at (0,0).

Unfortunately the Color Computer's high-resolution screen, like those of many computers, is not set up as trigonometry equations expect it to be. The horizontal direction is fine, but the vertical direction is reversed. Distances in the vertical direction increase as you go down the graphics screen instead of up. This means all of the *y* values must be reversed before we do any plotting.

Now we have almost everything we need to actually draw the star on the high-resolution graphics screen. The equations for the five points now look like this:

$x1=95*\cos(90)+128$, $y1=-95*\sin(90)+96$
$x2=95*\cos(162)+128$, $y2=-95*\sin(162)+96$
$x3=95*\cos(234)+128$, $y3=-95*\sin(234)+96$
$x4=95*\cos(306)+128$, $y4=-95*\sin(306)+96$
$x5=95*\cos(378)+128$, $y5=-95*\sin(38)+96$

Before we type in the program to display the star, we must remember that the Color Computer doesn't use degrees with its trigonometric functions such as sine and cosine. It uses something called radians. You may know about the term *pi*. *Pi* is a mathematical constant and equals approximately 3.14159. There are *pi* radians in 180 degrees or about 57.29577951 degrees per radian. Therefore we can convert degrees to radians by dividing all degrees by the constant 57.29577951.

Listing 1 is a fully commented program using the equations and constants mentioned above that will finally draw a perfect star on the high-resolution screen.

Now that we have these basics out of the way, we can become more creative. Let's draw multiple stars, rotated slightly from each other. You can choose the amount of rotation each time you rerun the program in Listing 2. This program uses an almost identical structure to Listing 1, except the angle is made variable and most comments have been removed.

Now see what other interesting designs you can come up with. As in my case, a little mathematics and a knowledge of the Color Computer's graphics abilities can make up for an unfortunate lack of artistic ability. ❑

16K Extended

90 104
170 10
END 2

Listing 1: TRIG1

```
0 ' COPYRIGHT 1989 FALSOFT, INC
10 REM LISTING 1 - DRAW STAR
20 PCLEAR4:REM RESERVE GRAPHICS
MEMORY
30 PMODE4,1:REM SET UP HIGH RESO
LUTION
40 COLOR0,1:REM SET BACKGROUND=W
HITE AND FOREGROUND=BLACK
50 PCLS:REM CLEAR GRAPHICS SCREE
N
60 SCREEN1,1: REM TURN ON GRAPHI
CS SCREEN
70 V=57.29577951:REM DEGREES TO
RADIANS CONVERSION
80 X1=95*COS(90/V)+128:REM X-VAL
UE AT POINT 1
90 Y1=-95*SIN(90/V)+96:REM Y-VAL
UE AT POINT 1
100 X2=95*COS(162/V)+128:REM X-V
ALUE AT POINT 2
110 Y2=-95*SIN(162/V)+96:REM Y-V
ALUE AT POINT 2
120 X3=95*COS(234/V)+128:REM X-V
ALUE AT POINT 3
130 Y3=-95*SIN(234/V)+96:REM Y-V
ALUE AT POINT 3
140 X4=95*COS(306/V)+128:REM X-V
ALUE AT POINT 4
150 Y4=-95*SIN(306/V)+96:REM Y-V
ALUE AT POINT 4
160 X5=95*COS(378/V)+128:REM X-V
ALUE AT POINT 5
170 Y5=-95*SIN(378/V)+96:REM Y-V
ALUE AT POINT 5
180 LINE(X1,Y1)-(X3,Y3),PSET:REM
 DRAW STAR LEG 1-3
190 LINE-(X5,Y5),PSET:REM DRAW S
TAR LEG 3-5
200 LINE-(X2,Y2),PSET:REM DRAW S
TAR LEG 5-2
210 LINE-(X4,Y4),PSET:REM DRAW S
TAR LEG 2-4
220 LINE-(X1,Y1),PSET:REM DRAW S
TAR LEG 4-1
230 GOTO230:REM LOOP TO ADMIRE C
REATION
```

16K Extended

70 188
150 28
END 115

Listing 2: TRIG2

```
0 ' COPYRIGHT 1989 FALSOFT, INC
10 REM LISTING 2 - MULTIPLE STAR
S
20 PCLEAR4:REM RESERVE GRAPHICS
MEMORY
30 PMODE4,1:REM SET UP HIGH RESO
LUTION
40 COLOR0,1:REM SET BACKGROUND=W
HITE AND FOREGROUND=BLACK
50 PCLS:REM CLEAR GRAPHICS SCREE
N
53 CLS:INPUT"AMOUNT OF ROTATION
(1-36)";R
55 IFR<1ORR>36THEN53
60 SCREEN1,1: REM TURN ON GRAPHI
CS SCREEN
70 V=57.29577951:REM DEGREES TO
RADIANS CONVERSION
75 FORA=0TO72STEPR
80 X1=95*COS((90+A)/V)+128:REM X
-VALUE AT POINT 1
90 Y1=-95*SIN((90+A)/V)+96:REM Y
-VALUE AT POINT 1
100 X2=95*COS((162+A)/V)+128:REM
 X-VALUE AT POINT 2
110 Y2=-95*SIN((162+A)/V)+96:REM
 Y-VALUE AT POINT 2
120 X3=95*COS((234+A)/V)+128:REM
 X-VALUE AT POINT 3
130 Y3=-95*SIN((234+A)/V)+96:REM
 Y-VALUE AT POINT 3
140 X4=95*COS((306+A)/V)+128:REM
 X-VALUE AT POINT 4
150 Y4=-95*SIN((306+A)/V)+96:REM
 Y-VALUE AT POINT 4
160 X5=95*COS((378+A)/V)+128:REM
 X-VALUE AT POINT 5
170 Y5=-95*SIN((378+A)/V)+96:REM
 Y-VALUE AT POINT 5
180 LINE(X1,Y1)-(X3,Y3),PSET:REM
 DRAW STAR LEG 1-3
190 LINE-(X5,Y5),PSET:REM DRAW S
TAR LEG 3-5
200 LINE-(X2,Y2),PSET:REM DRAW S
TAR LEG 5-2
210 LINE-(X4,Y4),PSET:REM DRAW S
TAR LEG 2-4
220 LINE-(X1,Y1),PSET:REM DRAW S
TAR LEG 4-1
225 NEXTA
230 GOTO230:REM LOOP TO ADMIRE C
REATION
```

XTEAM & OS-9

XTERM

OS-9 Communications program

- Menu oriented
- Upload/download Ascii or XMODEM protocol
- Execute OS-9 commands from within XTERM
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*Software by ColorVenture

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- Full block commands
- Find and Replace commands
- Proportional spacing supported
- Full printer control, character size, emphasized, italics, overstrike, underline, super/sub-scripts
- 10 header/footers
- Margins and headers can be set different for even and odd pages

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XSPELL OS-9 spelling checker, with 40000 word dictionaries

$39.95

XTRIO XWORD/XMERGE/XSPELL

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Includes detailed audit trails and history reports for each customer, perpares invoices and monthly statements, mailing labels, aging lists, and an alphabetized customer listing. The user can define net terms for commercial accounts or finance charges for revolving accounts. This package functions as a standalone A/R system or integrates with the Small Business Accting package.

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Give It Top Priority

by Greg Law
Technical Editor

This month we present an OS-9 utility written by Stephen B. Goldberg and called *Nice*. This assembly language utility allows you to alter the priority of a process so that it uses more or less processor time, thereby executing faster or slower than other processes. To copy the file `/d0/cmds/shell` to `/d1/cmds/shell` with a priority of 100, you type `nice 100 copy /d0/cmds/shell /d1/cmds/shell`. This is similar to executing `setpr` to adjust the priority except *Nice* allows you to adjust the priority before the process begins execution. Note that the listing shown is "pretty-printed" or columnized for clarity. Normally you would separate each field with only one space. Due to a minor quirk, the assembler generates jagged columns in the listing if the fields are separated by more than one space.

The listing begins with a few lines of comments explaining the usage of the command. Comments can be inserted anywhere in the source code by placing an asterisk (*) at the beginning of a line. Through the use of conditional statements the `/dd/defs/os9defs` file is included during Pass 1. This is used to speed up the assembly process since it doesn't need to read the `os9defs` file twice; `asm` is a two-pass assembler. That is, it reads the source file twice during the assembly process. During the first pass it creates the symbol table. During the second pass it creates the object code file and the program listing.

> **The assembler provides an easier method to access the current value of the program address counter and data address counter. The data address counter can be accessed via the dot (.) operator, and the program counter address can be accessed via the asterisk (*) operator.**

Before moving on, we need to define the mechanisms used to determine the size of the module and the data area size. One method is to physically count the number of bytes, but that is tedious and error-prone. Fortunately the assembler provides an easier method to access the current value of the program address counter and data address counter. The data address counter can be accessed via the dot (.) operator, and the program counter address can be accessed via the asterisk (*) operator. For example, you use `label equ *` to assign the current value of the program address counter to a label and `label equ .` to assign the current value of the data address counter to a label.

The `mod` statement defines the module header and initializes the data and code offsets to zero. Defined here is the length of the module, offset of the name string, module type and language, attributes and revision number, execution offset, and the amount of memory required for the data area. Of these, four are defined within the program itself. This will be explained later. The others are defined in `os9defs` as follows: `prgrm` denotes the module as a program, `objct` defines the module as 6809 assembly language, and `reent` indicates the module is reentrant. That is, it can be executed by two or more users simultaneously.

The lines with the `rmb` statements define the variables to be used in the data area. Note that no object code is actually created by these lines. Instead the assembler assigns the value of the current data address counter to the symbol and increments the data address counter by the number of bytes specified. The following line, `dsiz equ .`, assigns the data area size to the label that is used in the module header. Note that you can define labels to be used within the data area anywhere in the source code file. The only requirement is that you define the size of the data area via `label equ .` after the last variable in the data area is defined.

After the name, edition number and

In addition to being OS-9 Online SIGop, Greg Law enjoys programming on all types of computers and has worked on systems ranging from the CoCo to the Burroughs B6700 super mainframe. He lives in Louisville, Kentucky.

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copyright notice are inserted in the object code, the actual code begins. As defined in the module header, the program begins execution at the `entry` routine. This branches to the `bin` subroutine to convert a three-digit decimal number in ASCII that will be used as the priority to hexadecimal. After Register A is cleared and the result is stored in `priority`, the `convert` routine is executed four times. Upon each loop through the routine, the ASCII digit is converted to a hexadecimal digit and checked for validity. If the resulting digit is valid, the previous sum is multiplied by 10 and the current digit is added to the previous sum. If the digit is not valid, the loop executes up to four times using the same ASCII character. This technique allows it to convert from zero to three ASCII digits. If more than three ASCII digits are given on the command line, the final loop detects this and branches to the `syntax` routine.

The `findcmd` routine skips all spaces appearing after the priority and stores the address of the module name to be executed. After the module name is found, the most significant bit is set in the last character. The `findpram` routine performs almost the same function and stores the address of the parameters to be passed to the module. Once this is done, the process ID is obtained via the `F$ID` system call and the priority is set via the `F$SPrior` call. The routine is set up so that if no priority is specified, the default value of 100 will be used.

> **If the resulting digit is valid, the previous sum is multiplied by 10 and the current digit is added to the previous sum. If the digit is not valid, the loop executes up to four times using the same ASCII character.**

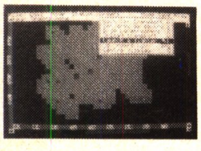
OS-9

The Listing: `nice.asm`

```
**************************************************
*
* NICE  -  (C)1989 by STEPHEN B. GOLDBERG
*
* Use: nice [priority] <command> [parameters]
*
* Run a command at the indicated priority (1-255)
* If the priority is omitted it defaults to 100
*
          ifp1
          use  /dd/defs/os9defs
          endc
*
          mod  len,name,prgrm+objct,reent+1,entry,dsiz
*
priority  rmb  1            process priority
npoint    rmb  2            ecommand name address
ppoint    rmb  2            command parameter address
          rmb  200          stack
          rmb  200          parameters
dsiz      equ  .
*
name      fcs  /Nice/
          fcb  1    edition number
          fcc  /(c)1989 S.B.Goldberg/
******************************
* CONVERT DECIMAL TO BINARY
******************************
bin       clra
          sta  priority     zero priority
          bsr  bin2         convert digits
bin2      bsr  convert      convert digits
convert   ldb  ,x           get character
          subb #'0          make binary
          cmpb #9           valid digit?
          bhi  back         no, return
          pshs d            save it
          ldb  priority     get previous total
          lda  #10          multiply by 10
          mul
          addd ,s++         add current digit
          tsta              more than 255?
          bne  syntax       yes, prompt and quit
          stb  priority     save total
          leax 1,x          bump pointer
back      rts               return
******************************
* INITIALIZE
******************************
entry     bsr  bin          get priority
findcmd   lda  ,x+          parameter character
          cmpa #$20         command name?
          beq  findcmd      not yet, look again
          blo  syntax       no command, prompt and quit
          leax -1,x         reset pointer
          stx  npoint       save command name address
endloop   ldd  ,x+          command name character
          cmpb #$20         end of command name?
          bhi  endloop      no, keep looking
          ora  #$80         set ms bit
          sta  ,-x          terminate command name
findpram  ldd  ,x+          get character
          cmpb #$20         command parameter?
          beq  findpram     no, keep looking
          stx  ppoint       save parameter address
******************************
* SET PRIORITY
******************************
          os9  f$id         get process ID
          bcs  out          exit with error
          ldb  priority     priority?
          bne  setprior     yes, set it
          ldb  #100         no, use 100
setprior  os9  f$sprior     set priority
          bcs  out          exit with error
******************************
* EXECUTE THE COMMAND
******************************
          ldx  npoint       command name
          ldy  #200         maximum parameter length
          ldd  #$0003       type/lang and data size
          leas 200,u        move stack to direct page
          ldu  ppoint       parameter address
          os9  f$chain      chain command
******************************
* SYNTAX ERROR PROMPT
******************************
syntax    leax <sprompt,pcr syntax prompt
print     ldy  #200         maximum length
          lda  #2           standard error path
          os9  i$writln     prompt to screen
          bcs  out          exit with error
          clrb              clear error
out       os9  f$exit       quit
*
sprompt   fcc  /Use: nice [priority] <command> [parameters]/
          fdb  $070a
          fcc  /     priority = 1 - 255/
          fcb  $0d
*
          emod
len       equ  *
          end
```

The registers are set up to execute the specified module. The address of the module name to be executed is stored in Register X. Register Y contains 200 for the parameter length, which should be more than sufficient. Register D contains the module type and language, and Register U contains the address of the parameters. The stack is relocated into the direct page via `leas 200,s` to ensure that the stack is located within an allocated area of memory. This is because the memory used for the data area is resized to the amount required by the called module. If the stack is not in the direct page, the `F$Chain` system call attempts to detect this and returns a Suicide Attempt error. The direct page register should reference the lowest 256-byte area allocated, which is the default. If the `F$Chain` system call returns an error, the `syntax` routine is executed. This routine prints the syntax for the command and exits with the proper error code.

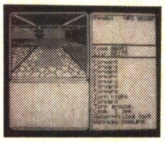
Finally the end of the module is defined via the `emod` statement, the module length is defined for the module header with `len equ *`, and the end of the source code is reached. I hope you've enjoyed it so far. Next month we will convert the source code for the RMA assembler.

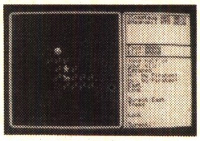


Overlord New!

Peace through superior firepower is the catch phrase in this sophisticated wargame simulator. Victory shall not fall to he who is the mightiest, oh no, but to he who can plan ahead and develop the better strategy. You must ensure that all your troops are brought into battle at the right moment, and for that you must set your most industrialized cities to producing troop transporters. Other cities will build Aircraft carriers, fighter jets, paratroop regiments, submarines, spy planes, battleships, destroyers, and cruisers. Up to three people can play the game simultaneously, each starting out at his own base city, each knowing nothing about the strenghts and locations of his enemies' forces. The player's own combat troops will head out, exploring the world as they go, capturing towns that lie waiting, or engaiging the enemy face to face. You can set any or all of the three players to be operated by the sinister silicon brain of your CoCo 3, and battle against them or let them battle each other.

Price: $29 US / $34 Cdn.
Overlord requires: 128k CoCo 3, 1 drive and a mouse or joystick.

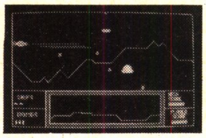




the Seventh Link

We've said it before and we'll say it again: This is the best fantasy role-playing adventure the CoCo has ever seen, bar none. A full 3 discs are filled with worlds, towns castles, and dungeons. The dungeons are spectacular 3D creations, filled with full colour, hi-res monsters, ladders, doors and pits, chests, pools, lava and flooded rooms. You would not believe that a CoCo 3 could produce such high-speed detailed graphics. The dungeons are only part of the story, however. In the wild lands above, you'll find monsters, towns and castles. The towns will reveal merchants, learned locals, even a friend or two who will join your quest. Maybe you will find band of pirates as you tread the windswept shores. Could you and your companions defeat them? Test your mettle during the hundreds of hours of play time The Seventh Link will bring you.

$38 US/ $48 Cdn. Req: CoCo3, 40 track drive (RS drive is OK if it's white)



Defendroid

A classic returns! Arcade realism for the Coco 3 is brought one step closer with this outstanding action game. Sinister aliens are appearing in the skies over Zabburtuth, and you and your Turbo-Flier are all that stand in their way! Use lasers and smart-bombs, fuel depots and your astronaut-tractor to save the hapless inhabitants from certain stir-frying as hideous alien cuisine!

This program contains a graphics manipulation routine so advanced, we registered a copyright for it alone. See what a threefold increase in software speed and memory efficiency can do for your CoCo 3!

Price $29 US / $34 Cdn **New!**
Defendroid requires: 128k CoCo 3, 1 drive, 1 joystick.

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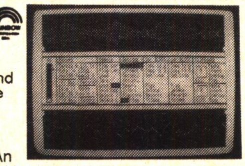
Requires: 128k CoCo 3, 1 drive



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$54 US/$64 Cdn with cable $39/$49 wo
Requires: 128k Coco3,drive, mouse/joystick

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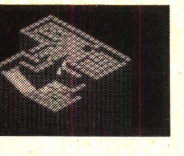
Hint Books!

Finally, help is here! Calduril 1 and 2 books are 15 pages and $3.50 each. The Seventh Link books are 40 pages (lots of maps) and $5.50.



New! **Those Darn Marbles**

Dedicate a program to 512k machines only, and all sorts of new things are possible. Those darn Marbles is the first CoCo game to use the built-in hardware screen scrolling features of the CoCo 3. This means that all the computer's time cn be dedicated to controlling the game itself (sound effects, moving objects around, etcetera) rather than the time-intensive chore of scrolling an entire 32k screen around. You will be amazed to see how smoothly a HARDWARE-scrolled screen can move. Compare Those Darn Marbles with any other 3D marble type game on any computer, and you will be convinced that your CoCo 3 really can stand with the best of them. (One of our playtesters remarked, upon seeing the pre-release version of TDM: "My Amiga isn't that smooth!")

Not convinced? TDM is so chock-full of graphics that it comes on (count 'em) six discs!

It's been said many times, but this time it's true: Your CoCo 3 game library is not complete without a copy of Those Darn Marbles.

Price $32 US / $38 Cdn. Requires: 512k CoCo 3,1 drive,joystick.

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```
 Page 16
Screen 3
==========================================================================
\ SIEVE FOR FORTH09 (C)'89 K.S. RADCLIFFE            KSR891205 \ 0
\ (SIEVE) corresponds to the outer loop in basic, & it calls    \ 1
\       the inner loop, DOZERO, that was just defined.        \ 2
: (SIEVE) 0 SIZEOF 0 DO                 \ for i=0 to sizeof     \ 3
         I FLAGS + C@                                  \ 4
         IF                 \ if flags(i) then             \ 5
          I I + 3 + I OVER +  \ prime=i+i+3: k=i+prime       \ 6
          DOZERO ++ PRIMES    \ doinnerloop: count=count+1   \ 7
         ENDIF              \ endif                     \ 8
       LOOP DROP ;            \ next i                     \ 9
: SIEVE CR .TIME CR 10 0 DO           \ for iter=1 to 10            \ 10
               0 TO PRIMES \ count=0: for i=0 to sizeof \ 11
               INITIALIZE  \ flags(i)=-1: next: print    \ 12
               (SIEVE)     \ "Initialized": doouterloop: \ 13
             LOOP .TIME     \ next iter: print "primes=" \ 14
     ." Primes=" PRIMES . CR ; \ ;count: end                 \ 15
```

Software OS-9

FORTH09— A FORTH Compiler

FORTH09 from D.P. Johnson is a professional grade system, well-suited for the production of commercial software, and is also a super-set of the FORTH-83 standard (so named for the committee that met in 1983). The system has been designed and optimized for the 6809 and for OS-9. It requires OS-9 Level I or Level II, at least one floppy drive (double-sided, 40-track recommended), and — if you plan to use the full-screen editor — a monitor capable of 80-column text. Running the system using the default configuration requires 48K of RAM.

Here are some of FORTH09's features:

- The editor is a full-screen FORTH editor that is easy to use and learn. It is configured to work with one of three terminals, as well as the CoCo 3.
- A 6809 FORTH assembler is provided.
- The compiler is an adjustable optimizing compiler that generates reentrant 6809 machine code.
- Programs written in FORTH09 can be saved as executable files that are independent of FORTH09. To save space, all verb headers and FORTH09 compiler code are removed from the program when it is saved to disk.
- Source code for the extensions of the FORTH09 kernal is included.
- All I/O is done through OS-9.

Installation

FORTH09 comes on one single-sided 35-track disk, accompanied by a typeset manual. The system disk contains four programs: `fload`, `forth`, `sqz` and `unsqz`. There are four text files: `block.sqz`, `block.s.sqz`, `changes` and `readme`. The `.sqz` text files are compressed, so you must run the program `unsqz` to unsqueeze them. These files contain the source code for the FORTH09 extensions. The installation procedures are clearly explained in the documentation that comes with the system, and I had no problem getting the system up and running. Neglecting to read the manual *and* the `readme` file first would bring nothing but grief. There is only one problem with making a first-time installation: In order to make FORTH09 work with the printer on the CoCo 3, the print driver descriptor `/P1` in the block source file must be changed to `/P`.

The FORTH09 Editor

The editor included with FORTH09 is a solid, functional, full-screen editor that manages to stay out of the way while I'm working. It can be configured to operate with the Wyse 50, 75 or the QVT-102 terminals, as well as the CoCo 3. For systems without 80-column capabilities, there is a line editor available as well.

Eight of the major editing keys are labeled at the bottom of the display, so references to the manual are kept to a minimum. FORTH editors work with 1K blocks of text called *screens*. Instead of loading and editing an entire program file, the FORTH editor handles source text one screen at a time. In this editor, traversing the file foreword or backward is accomplished through the use of function keys.

Commenting and documenting FORTH programs has been a real challenge for me, as there never seems to be a logical place to put the comments. To address this problem, the FORTH09 editor supports *shadow screens*. These are screens (in a separate file) designed to hold comments and documentation. One function key flips from program text to shadow screen and back again.

Automatic date stamping of each screen is available. When a screen is edited, the date appears in the upper right corner.

Each screen can be write-protected to eliminate accidental changes, and if changes are made accidentally, there is an "undo" function key. "Undo" restores the whole screen to its original state, provided that it hasn't been saved first. As with any FORTH editor, block operations have to be done outside the editor. No text-searching commands are available.

An Overview of FORTH

It may seem to the majority of programmers that FORTH is something so utterly foreign and unusual that it would be a waste of time and energy to deal with it. In this overview of FORTH and the review of the FORTH09 compiler from D.P. Johnson, I hope to show that the language is not so foreign after all.

FORTH and OS-9 have a lot in common. They were both designed to make efficient use of limited computer resources and to provide a powerful set of tools to manage these resources. They both have a quality I call "structured flexibility." The structure is an ordered and consistent environment that can be extended and modified to adjust to changing requirements. Like OS-9, FORTH is a powerful programming tool that has been little understood and ridiculed by its opponents, and religiously over-promoted by its adherents.

Originally, FORTH was designed to be an operating system and a program development system that was small, fast and flexible. As an operating system, it has been so adaptable to different hardware that it has been installed on almost every type of computer system from one-chip micro-controllers to mini-computers. In a "standard" installation, all devices are either block devices or character devices. As the designers of OS-9 and UNIX have found, this simplifies programming and modifying the system.

As a program development system, FORTH is designed to reduce or eliminate the need for a separate hardware or software debugger. There are commands (or *verbs*) for memory dumps, block moves and block fills, and also verbs that manipulate bytes, words and double words. Most systems provide a single or multiple break point verb (like the `STOP` command in BASIC). Other options include single-stepping and disassembly tools.

FORTH is interactive, similar to the direct mode in Extended Color BASIC. As a program is developed, small, logical sections of code can be executed and debugged.

The FORTH editor and the FORTH assembler are online at all times. The editor can be anything from a crude, primitive line editor, to a friendly, sophisticated full-screen one. The "edit-compile-run" cycle is very similar to the cycle in BASIC09. Programs are written by modifying and extending FORTH. The resident commands, or *verbs*, are used to define new verbs, which in turn can be used in the definition of other verbs. Any part of the system can be extended or modified, including the compiler. In the end, FORTH becomes whatever the programmer wants it to become.

FORTH and C are both intermediate languages, while languages like BASIC09 and FORTRAN are considered higher-level languages. In situations where C is appropriate, FORTH is also appropriate. Generally, FORTH code uses less space than C code and, depending upon the job (and quality of the compilers), execution speed is about the same.

With all these good points, why isn't FORTH embraced by the vast majority of computer enthusiasts? One reason might be that it takes some time and a fair amount of persistent effort to learn the language. When you first begin to write code in FORTH, nothing about it seems familiar, especially if you have not read books like *Starting FORTH* by Leo Brodie. If I had read it, I could have saved about three months of work. There is nothing in the typical FORTH documentation that shows how to program in FORTH or how to use the features of the language. Since it uses fairly exotic techniques, the novice is lost almost from the start.

The design skills of the programmer also need to be more advanced. Any intermediate language that requires the use of "structured programming" techniques almost demands systematic and disciplined planning and design work before coding begins. It is generally not a good language for casual use.

FORTH was designed to control and manage hardware, and it has only been in the past five years that FORTH has been modified to work in conjunction with operating systems like OS-9 and MS-DOS. In the past, only the most expensive FORTH compilers produced stand-alone code. Therefore, most FORTH code could not be readily distributed. Now more of the affordable systems have the capability of producing quality, stand-alone programs.

Most other compiled languages have libraries of code that can be used to provide capabilities lacking in the language itself. This is not generally true with FORTH. FORTH (like C) lacks many of the string-handling commands we take for granted in BASIC. It lacks the code necessary for floating-point math, although this is not a problem in many situations.

With this knowledge and the information presented in the review of FORTH09, you can decide if FORTH is right for you. ❑

There are tradeoffs for these features: shadow screens take more disk space (but they are optional), and extra features take more RAM. For me, the greater functionality has been more than worth the cost.

The Compiler

Some of the FORTH09 verbs have been designed to be compiled as inline code when conditions permit. If the number of bytes of inline code is less than the value of the variable `COMPLIMIT`, then the verb will be compiled inline. Otherwise the verb will be placed in a subroutine. A list of all verbs with inline code, and the number of bytes generated by each, is included in the manual. If `COMPLIMIT` is 2, then the least amount of RAM is used. If `COMPLIMIT` is 37, then the fastest code is generated. Setting this variable to more than 14 or 15 does not gain much speed, but makes the programs larger.

There are verbs included that take advantage of the speed gained by storing data in direct page RAM. There is a section of the manual that discusses these commands and how to optimize a program for speed. Although the section is short, it is complete. There is vast language support for communicating with OS-9, a large portion of which is optional, so if you do not plan on using calls to OS-9, the support code will not be taking up space in memory. Most of the I/O service requests and about half of the user mode service requests are implemented. Since the source code for these calls is supplied, it becomes a trivial matter to implement any call that is not supported.

FORTH09 is interactive, so it is possible to explore these calls to OS-9 directly from the keyboard. For example, the `I$GetStt` call returns 32 bytes of status information of any path number passed to it. To set up a 32-byte "variable" called `STATDATA`, type and enter `32 RMB STATDATA`. To fill this variable with the status of the standard input device, enter `STATDATA 0 GET.OPT`. Now to quickly display the status data in Hex, enter `HEX STATDATA 20 DUMP`. For hard copy, enter `STATDATA 20 >PRINTER 20 DUMP >SCREEN`. The `DUMP` verb gives a formatted display in Hex and ASCII of the data contained at the address of interest. The verb `ERROR#` returns the error number passed back by the last call to OS-9. Entering `ERROR#` will display the value of that error, if any.

Compiled program code is kept in a dictionary, and unlike other FORTH systems, FORTH09 has two dictionaries: a primary and a secondary one. The secondary dictionary is used to store code normally associated with the compiler, or for code that will not be needed in running the final program. For example, the verb `RMB` is a compiler verb used to define variables of any length. `RMB` is a verb from the secondary dictionary, and when a program that uses this verb to define a variable is saved as a stand-alone program, the code for the verb `RMB` is not saved with the program.

This concept of two dictionaries serves two purposes: It helps the programmer minimize the size of the final executable code, and it simplifies the task of extracting the executable program from FORTH09.

A vocabulary in the dictionary is very much like subdirectories in OS-9. This mechanism is used to keep related code and data blocks separate from the rest of the system. Usually the editor is kept in a separate vocabulary, as is the assembler.

Although vocabulary support is available in FORTH09, another important mechanism has been introduced that does away with the need for vocabularies and seems to be easier to use. A block of code can be declared as being `LOCAL`. At the end of this block a `GLOBAL` command is issued. After all verbs that use the local code have been defined, a `MODULE` command is executed, which has the effect of removing all local verbs from the dictionary, and the local verbs can no longer be used in any other definitions. The verb `HIDE` can be used on individual verbs with the same effect.

In the past, all disk and terminal I/O was controlled directly by FORTH. Although this made the programming environment uniform over a wide range of hardware, it locked the FORTH programmer out of other popular operating systems. With FORTH09, all disk and terminal I/O is handled by OS-9. There is a complete set of commands available that implement the system calls to OS-9 for reading, writing, opening and closing devices and files. By now, you must be wondering about the graphics capabilities of FORTH09. Although no extensions have been provided that implement any graphics commands, they are fairly easy to write because graphics are built into OS-9. All commands in sections 3 through 5 of the OS-9 Windowing System, in the OS-9 manual, can form the basis of any graphics commands you want to write.

Once a program has been written and debugged, the `SAVE` or `XSAVE` verbs can be used to make a stand-alone executable file. `XSAVE` is more versatile than `SAVE`, because the amount of data memory can be changed, and the filename can be different from the name of the verb that starts program execution. The smallest program I was able to save consisted of a do-nothing verb. The executable file was 2999 bytes long. A program that prints "Hello world" to the screen was 3000 bytes long. These programs were saved with almost all FORTH09 extensions loaded. The programs `SQZ` and `UNSQZ`, the compress and decompress utilities written in FORTH09, were saved with almost no extensions loaded. They are not exactly "trivial" programs, but the executable files are only 2956 and 2895 bytes long, respectively.

I use *Multi-Vue* in some of my work, and I have used FORTH09 under *Multi-Vue*. I find that editor performance really suffers when loaded in a graphics window; and even when I use a text window, its performance is barely tolerable. Aside from this, there seem to be no other problems running FORTH09 with *Multi-Vue*. I haven't yet settled on the most effective way of using FORTH09 with *Multi-Vue*, but it doesn't seem to be taking any more effort than it has taken to get BASIC09 to interface with *Multi-Vue*.

In Conclusion

Some programmers I have spoken with think of FORTH as an ancient, dead language. In contrast, I have used FORTH09 to successfully explore and implement the newest programming techniques found in Object Oriented Programming (OOP). I can't honestly say that FORTH is an easy language to learn, but I *can* say that it is no harder to learn than C, and it is easier to learn than assembler. If you have what it takes to master C or assembler, you have the ability to master FORTH09. It is a unique implementation of FORTH-83 that has combined the power of OS-9 and FORTH. Having used FORTH professionally in the MS-DOS environment, I am delighted with the thoughtful design and performance of FORTH09, and I do not hesitate to recommend it to others.

(DP Johnson, 7655 S.W. Cedarcrest St., Portland, OR 97223, 503-244-8152; $150 plus $3 S/H)

—Keith S. Radcliffe

Software CoCo 1, 2 & 3

C.R.T.'s Collection— Public Domain Software

Since the beginning, intrepid programmers have written and distributed programs for free or for very little money. With the advance of bulletin board systems (BBSs) and cheap modems, these programs have become available to more and more people. And the cost is simply for the time it takes to download them. For those without a modem, though, the only way to get these programs has usually been to find a friend who owned a modem — and was willing to do the downloading.

C.R.T. Connection is one of several companies in the CoCo Community that fills the niche by offering shareware/public domain programs to those without the benefits of a modem. It offers a variety of programs (103 disks) under the following headings: Utilities, Games, Graphics, Telecommunications, Music (*Orchestra-90* and *Musica* files) and Educational. Each category of disks is available separately. Except for an OS-9 telecommunications disk, all the programs run under Disk Extended BASIC for CoCos 1, 2 and 3. Most of the graphics files offered are for the CoCo 3; but there are several for CoCos 1 and 2.

All of the programs and graphics offered are either freeware or shareware (programs distributed free of charge but whose author requests a small donation). While users are under no obligation to send any money, doing so tends to encourage the programmer to write more and better programs for distribution.

The programs I received were of good quality and performed well. They included a label editor, two disks for use with the Speech/Sound Pak, an Adventure game, a program that produced insults, and some animated CoCo 3 graphics. For the most part, running the programs is fairly straightforward (either `RUN"`*filename*`"` or `LOADM "`*filename*`":EXEC`). Programs that need explanation include a `README` program the user can run for directions and information. I found this out by calling up the directory of each disk and experimenting, because only the disks and no documentation were sent to me.

I called C.R.T. about a minor bug in the label editor program, which changed the printer baud rate to 2400 baud without telling anyone. The support person said it would be fixed right away and offered to send me the new program. However, I declined because the program works fine except for the bug. But this shows the company's willingness to correct mistakes and to maintain a good relationship with customers. This is a trait I've found in my dealing with CoCo software vendors, and it's nice to see it in a new homegrown business.

With prices per disk ranging from $3.50 (for one to four disks) to $2.50 (for 11 or more disks), C.R.T. Connection is fairly inexpensive — perhaps cheaper than long-distance rates in some areas. I recommend it to those looking for an inexpensive source of quality public domain software.

(C.R.T. Connection, 3625 Orange Ave., Fort Pierce, FL 34947, 407-464-9873; $3.50 or $2.50 per disk plus $2 S/H per 20 disks ordered)

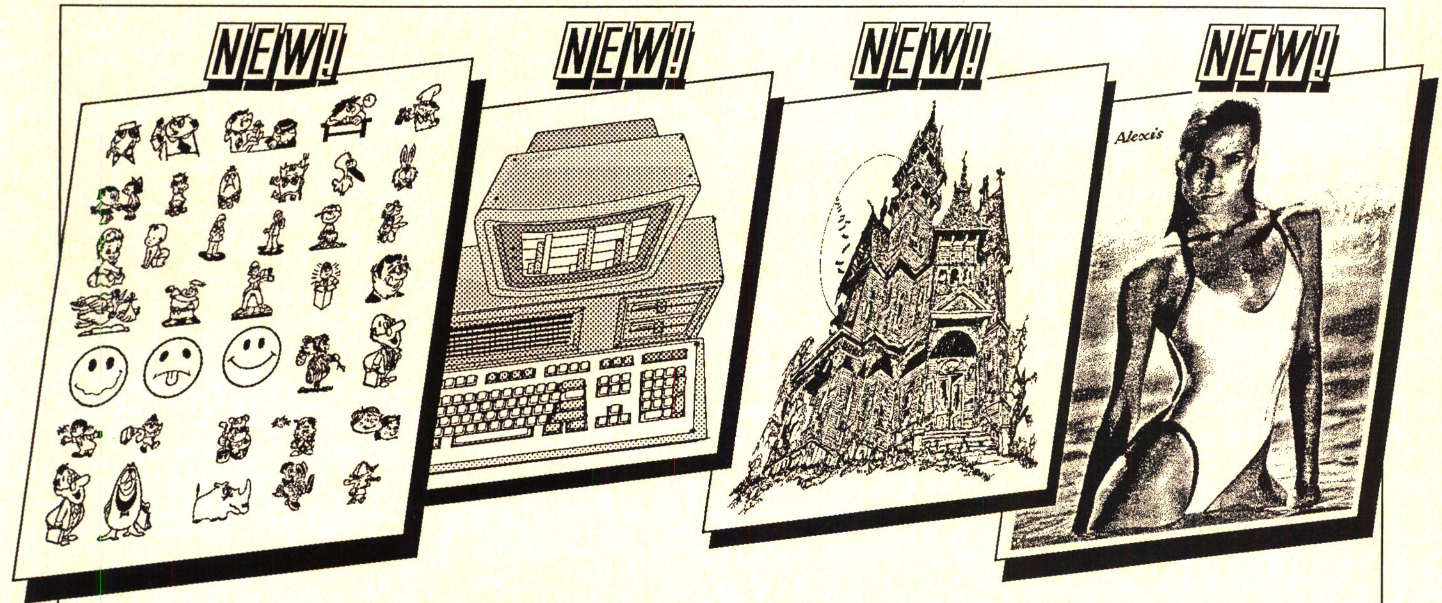
—Chris Hyde

Software CoCo 3

Utilities & Subroutines for BASIC— A Programmer's Piece of the Rock

The Gibralter Software Company of Rowayton, Connecticut, has released a collection of utilities and subroutines for the Color Computer. The collection includes a number of free-standing utility programs plus several subroutines that can be incorporated into your programs or used alone.

`DISKMEMO` is an enhanced disk directory display utility. Descriptive program name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tags of up to 48 characters can replace the standard 11 characters (eight for name, three for extension). Disk directories are displayed in five-column format, with free granule space shown at the bottom. Pressing the F1 key allows you to add or edit a descriptive program memo. Programs can be loaded or run by highlighting them, then pressing F2. A number of other handy options include Copy, Rename, Kill, Auto Copy and Change Disk. A memo can be copied from one program to another.

Another program featured is `S&R.BAS`, a search-and-replace utility for BASIC data files. Files must be in ASCII format for `S&R` to work. The program is quite versatile and well-suited to making global changes in small files. Gibralter has also seen fit to include a drawing program, *Quickdraw*, which operates in `PMODE 4` two-color mode. Although the program provides adequate drawing capability, the lack of a printer routine weakens it quite a bit.

Perhaps the most clever inclusions in the collection are three subroutines that allow users to add calculator functions to their own programs. Two versions of a simple calculator plus a scientific version are offered. The basic calculator is available in either 40-column or 80-column versions for the CoCo 3. When called from BASIC, the calendars occupy only four lines on the screen and offer simple arithmetic functions. In addition to +, -, *, ; and =, other options include F1 (+/- key on calculator), F2 (1/*x* key on handheld), Memory, Return Memory Value, Clear, Exchange Memory and Display Values and Q(complete calculations). The scientific calculator offers additional functions such as sine, arcsine, cosine, cube, cube root, and more.

`NOTEPAD` can be incorporated into frequently used BASIC programs, allowing a user to call it up, jot down a note or thought to be saved to disk for later recall, then return to the main program. Disk I/O functions are accessed by pressing ALT-D. Load, Save and Print are available from within your BASIC program. A separate utility allows "batch" printing of Notepad data files.

Subroutines for working with the high-resolution `HSCREEN1`, `HSCREEN2`, `HSCREEN3` and `HSCREEN4` modes are included. One, `HINPUT`, allows the use of limited data input without having to leave the high-resolution mode. The `HTIMER` routine is used to time any type of program activity you want.

The program documentation describes the syntax and functions for each part of the collection. Examples for using the individual programs or subroutines are provided, and BASIC programmers with a good understanding of the language should not encounter difficulty in utilizing the subroutines. At $14.95 for the complete package, Gibralter's *Utilities & Subroutines for BASIC* is a good value for CoCo 3 BASIC users.

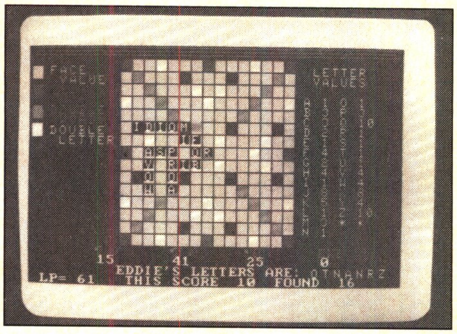
(Gibralter Software, 65 Bluff Ave., Rowayton, CT 06853, 203-838-9284; $14.95 plus $2 S/H)

—Leonard Hyre

Software CoCo 3

Vocab— Whaddaya Mean, "Xabawoghy" Isn't a Word?

Rick Cooper's *Vocab* program for the CoCo 3 is another way to get a family argument started. After all, there are some people who, when playing *Scrabble*, invent a word so they can get rid of the high-scoring tiles in their rack. They then try to bluff you into accepting a word such as *xabawoghy*.



Vocab is a means of playing a game closely resembling the Parker Brothers version by using your 128K CoCo 3 with a disk drive. It allows up to six players, one or more of which can be the computer. The three pages of instructions tell you all you need to know to back up the game disk, start the game and fix your goofs if you make any. Simple.

Of course the basic moves in chess are simple also. There are only six different regular moves in chess. All else is learning when to make them, right? This is why I haven't quite reached international grand master level yet — that pesky timing problem. Should have it solved by the year 2400.

It's the same with *Vocab*. There are only 26 different letters in the English language, and some of them, such as *x*, are basically useless unless you're an algebra teacher. Therefore, all you have to do is put them together in the correct combination to form record-breaking words, right?

Right. That's all you have to do, if you are the only player. *Vocab*, by the way, allows you to play by yourself if you want. It also plays against you if all human competitors are boycotting you and your bizarre astrobiochemical terms. It even demonstrates the game for you by becoming all the players.

If the computer is designated to be one of the players, be prepared for an unusual word now and then, such as *xu*. Still, Mrs. Vocab did produce *oyez* and *bison*. She's who you'll play against if you choose two players, one of which is your CoCo. This tells me that Mrs. Vocab, like my wife, is a lethal word-game player. Mr. Vocab doesn't get to play unless there are three of you, so he must not be that tough. My wife has also come up with a word such as *xu* on occasion, then reads its definition from the dictionary, with a completely straight face. It may be significant to point out that she is slightly ahead, 67 games to 37 games over the 15-year galactic championship tournament period, for perfectly logical reasons: She's smart, well-read and clever. And sometimes just a teensy bit devious.

Make sure you type *all* the letters in the word you're forming, even the ones already on the board. You'll cheat yourself out of points if you don't.

If you happen to goof up a word while typing it in, you can correct it by pressing the CLEAR key. However, once it is in there, you can't do that, which might be a program weakness. There are times when the word itself is great but the cross-words are garbage, which nobody realizes until it is too late.

The graphics are excellent, displaying what looks very much like a *Scrabble* board. The screen also displays square values, letter values, each player's score, how much the last word played scored and the number of letters left in the letter pool. In other words (yuk, yuk), it tells you everything you need to know except what to do with a rack full of *i*'s.

You can trade your letters in for a new set and cost yourself a turn. I had to do that once when the only thing I could produce was *etaoin shrdlu*, which somebody claimed was a proper noun.

The other minor weakness in this program is that you can't study the tiles in your rack as another player is taking a turn. The only letters displayed are the ones for the current player. Of course, players can agree not to look at each other's letters. An honor system, of course. (Sure, my honor and his system.) On the other hand, if you can't look ahead, you won't be disappointed when a player in front of you steals the 151-point word you had planned. Fistfights have ensued for less provocation.

Oh, yes. *Vocab* subtracts the value of unused letters from each player's score when the game ends, so if you're still hoarding the Q, the X and a Z, you are going to be in big-time trouble.

Vocab is quite a good program for $19. Now that the weather is ugly, you could do a lot worse for brain exercise than play this game for a few hours while waiting for the robins to return.

(SPORTSware, 1251 S. Reynolds Road, Suite 414, Toledo, OH 43615, 419-389-1515; $19)

—John M. Hebert

Software CoCo 1, 2 & 3

DSKLBL 1.1— Directory Printout Specialist

Are you looking for a neat little utility to print disk directories on form-feed labels, disk jacket inserts and custom disk jackets? Wouldn't it be great to know what's on a disk without having to type `DIR`? Just by *looking* at the disk, you could see what's on it? Then look no further! *DSKLBL 1.1* is right for you.

DSKLBL, which comes on a nonprotected disk, is a menu-driven label program written in BASIC. Requirements include a 32K Extended BASIC CoCo, a disk drive and a printer.

The opening menu allows you to choose what you would like to print (labels, inserts or jackets), lets you specify an optional title and also lets you set the printer baud rate.

Labels can be printed and attached to the disk itself or to the disk jacket — or to both. An insert is a directory of filenames printed on paper, rather than on a label. It is then *insert*ed into the disk jacket.

If you opt to print out a disk jacket, you'll have room for 72 filenames, including extensions. It also prints the number of free granules on the disk. After the jacket is printed, you simply cut on the dotted lines, glue it together, and insert your disk. It is simple enough that even *I* can do it!

The program asks for the number of lines available on the label and the number of those lines you want to print. It warns you when and if you have too many filenames on one label. It takes some trial and error to fit the correct number of filenames on a label, although the manual provides some guidelines.

DSKLBL is programmed to print in standard, compressed or elite fonts. It allows you to modify the printouts for different printers and different fonts.

DSKLBL's onscreen prompts allow users to print labels, inserts and jackets flawlessly. At $5, the price is right for this nifty labeler program.

(King Cottage Industries, 1814 Valley Street NE, Poulsbo, WA 98370, 206-697-5576; $5)

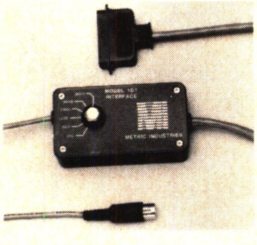
—Lee Deuell

Software CoCo 3

Super Disk— Copy Protection 101

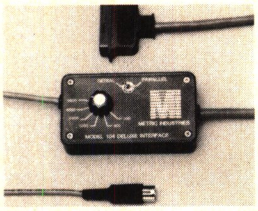
SPORTSware's *Super Disk* is a collection of disk-related utilities for CoCo 3 users who want to learn about copy protection in order to protect their software — as well as for those who are simply curious or want some handy utilities. Many of the programs provided in *Super Disk* are *not* for the novice programmer, and in fact

METRIC INDUSTRIES, INC.



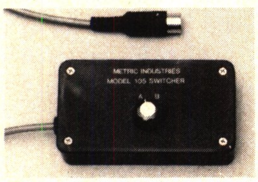
Model 101 Serial to Parallel Printer Interface

- ★ Works with any COCO
- ★ Compatible with "Centronics" Parallel Input Printers
- ★ Just turn the knob to select any one of 6 baud rates 300-9600
- ★ Comes complete with cables to connect to your printer and computer
- ★ Can be powered by most printers



Model 104 Deluxe Interface with "Modem Switch"

- ★ **Same Features as 101 Plus**
- ★ Built in Serial Port for your Modem or other serial device
- ★ Switch between Serial Output and Parallel Output
- ★ Comes with cables to connect to your computer and printer
- ★ Can be powered by most printers



Model 105 Serial Switch

- ★ Connects to your COCO to give you 2 switch selectable Serial Ports
- ★ Comes with a 3 foot cable to connect to your computer
- ★ Now you can connect your Printer (or printer interface) and your Modem (or other serial device) to your COCO and flip the switch to use either device
- ★ Does not require power

Cassette Label Printing Program

- ★ **New Version 2.1 prints 7 lines** of information on Cassette labels
- ★ Comes on Tape with instructions to transfer to disk
- ★ Menu driven, very easy to use
- ★ **Save and Load Labels from Tape and Disk**
- ★ Uses the features of your printer to print standard, expanded, and condensed characters
- ★ **Automatically Centers Each Line of Text**
- ★ Allows editing of label before printing
- ★ Program comes with 24 labels to get you started
- ★ 16K ECB required

Some of the Printers That Can – Supply power for the 101 and 104 are Radio Shack, Star, Okidata, Brother, Juki, and Smith Corona.

Some of the Printers That Cannot – Supply power for the interfaces are Epson, Seikosha, Panasonic, Silver Reed and NEC. If your printer cannot supply power to the interface you can order your interface with the "P" option or you can supply your own AC adapter. We recommend the Radio Shack 273-1431 AC adapter with a 274-328 connector adapter.

Write or call for more information or for technical assistance.

Price List

Model 101	**35.95**
Model 101P	41.95
Model 104	44.95
Model 104P	51.95
Model 105	14.95
Cassette Label Program	6.95
Pin Feed Cassette Labels:	
White	3.00/100

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Female/Female 6 foot	4.49
Other Lengths Available.	

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assume a good understanding of BASIC and some familiarity with assembly language. However, there are some programs on the disk that require little or no programming knowledge to use.

Super Disk allows you to easily add copy protection to your disks, and also to learn more about other copy protection techniques. I emphasize the word *learn.* Careless use of these utilities could destroy valuable software if used improperly. On the other hand, the software and instructions are excellent tools to familiarize yourself with the disk operating system (DOS) and disk format. Without a good understanding of the operating system, you really can't devise effective protection techniques.

The 34-page instruction manual is well-written and contains excellent descriptions of the program's operation. Much of the manual deals with various copy-protection techniques as does *Super Disk* itself. Quite a bit of discussion centers around the CoCo's disk operating system and how Tandy utilizes the physical attributes of the disk drive and disk in unique ways. Also explored in detail is the floppy disk controller and what makes it tick.

Each of the various utility programs on the disk performs a specific function and is called by the main program — *The Snooper.* These programs or modules can be used to examine or change sectors and data. You can fill all or part of a sector with a specific byte pattern, print data to the screen, recover lost files and, of course, perform copy protection functions. You can select the drive number (0 to 3), track number and sector, convert Hex to decimal, and write/dump/change/look at a specific byte on the disk. Preambles and postambles are also examined. These are used to find the starting and ending points of a disk file.

The `READTRAK` module allows you to load any track that exists on a disk and scroll through the entire track. Everything from the leading gap to the ending gap including sync bytes, CRCs, address marks, ID fields, and data fields can be seen — even on protected disks. `READTRAK` is very useful when you want to look at information not intended to be seen.

Examining copy-protection techniques is an interesting "sport" to some hackers, and many get a great deal of satisfaction in breaking a protected program. There is nothing wrong with this activity as long as the hacker doesn't share this knowledge with others or use it to deprive the software company of its livelihood.

`NOCOPY` is a common type of protection scheme; `NOCOPY` invalidates the `BACKUP` command — the disk cannot be copied with the `BACKUP` command. `ANALYZE` very quickly tries to find tracks 0 through 39 on any disk by looking at Sector 1 of each track. This is a fast way to spot nonstandard disk formats.

Copy protection is also provided for the user's BASIC programs. The author does a fine job of illustrating how BASIC programs can be just as effectively protected as machine language programs.

`FORMAT` and `DSKIMODI` allow you to create unlimited disk formats. The use of special format schemes lets you create programs that only your computer system can read, if you care to go that far.

`DOSVARIA` is an educational tool that can be used to examine most of the disk I/O variables used by the system DOS. This is a good starting point in learning about I/O buffers, disk variables and the file allocation table (FAT).

`COPYPLUS` is a combination format and copy utility that performs both operations at the same time. It requires two disk drives and eliminates the user having to preformat disks. `FASTFORM` is a handy utility that formats a 40-track disk in half the time taken by `DSKINI`.

SPORTSware's *Super Disk* is a complete package of disk utilities for your CoCo 3 and a disk drive. The programs and instruction/tutorial manual are professional in content. Many of the screens are done in the 80-column mode, and they are colorful, easy to read and well-designed. *Super Disk* is software for serious programmers and others who want to learn about software hacking.

(SPORTSware, 1251 S. Reynolds Road, Suite 414, Toledo, OH 43615, 419-389-1515; $49)

—Robert Gray

Hardware

CoCo 3

Dual Hi-Res Joystick Adapter— Eliminates Cord Tangle

As fun and powerful as the CoCo 3 is, it presents some problems to many when it comes to the joystick interface. The new Hi-Res graphics capability has led to a wealth of programs sporting all kinds of graphics potential, many of which must be accessed with a special Hi-Res joystick adapter interface.

Tandy and Colorware have taken the lead role in providing software and hardware that take advantage of the finely detailed Hi-Res capability. But don't forget that there are still quite a few popular "old" programs that use Lo-Res graphics and require the standard joystick port and no interface. The result of this variety of software is that you find yourself constantly plugging and unplugging various Hi-Res adapters and joysticks depending on the program you are running.

The popular Tandy Hi-Res Joystick adapter (#26-3028) has to be plugged into the joystick port and the cassette port. Now what do I do if I want to use the cassette recorder while the Hi-Res interface is plugged in? You guessed it: unplug the interface and plug in the recorder. Then unplug the recorder and plug the interface back in when I'm done.

If I want to use the joystick in the normal Lo-Res mode, I have to unplug the adapter, plug the joystick directly into the CoCo 3, then undo all that and plug the interface back in when I want to run programs that take advantage of the CoCo 3's excellent graphics. Let's face it; the CoCo 3 just won't take a lot of abuse, and continual plugging and unplugging of devices into any of its ports can lead to nagging intermittent problems.

HAWKSoft has found a better way. It is now marketing a modified version of Tandy's Hi-Res joystick interface. The modification results in the addition of a cassette port and three miniature switches. By throwing the switches in different combinations, this single adapter can be used for programs requiring the Tandy interface, the Colorware interface, or no interface at all. The addition of the handy cassette socket means that you can plug this interface into the computer and plug the cassette cable into the added socket on the interface — and you're done. No more plugging, unplugging, tangled cables or wrangled nerves.

The HAWKSoft Dual Hi-Res Joystick Adapter is simple to install, works great and eliminates a lot of frustration. It comes with easy-to-understand operating instructions and hooks up in less than a minute. The switches are not labeled on the interface itself, so you have to consult the illustration in the instructions to figure out which switch does what, although once you get used to the switches it becomes pretty easy to switch back and forth between the various modes.

I recommend using some simple stick-on labels when you first hook up the adapter. It would be nice if HAWKSoft would do that for us, but there isn't much room on the tiny case (which measures 2 3/8-by-1 5/8-by-1 1/8 inches).

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HAWKSoft's Dual Hi-Res Joystick Adapter adds, it doesn't take long to conclude that the $40 price tag is fair for this gadget. In addition, HAWKSoft offers an Economy Adapter for $27 that works the same except it doesn't support the cassette port or Colorware functions.

(HAWKSoft, P.O. Box 7112, Elgin, IL 60121, 312-742-3084; $40; Economy Adapter, $27)

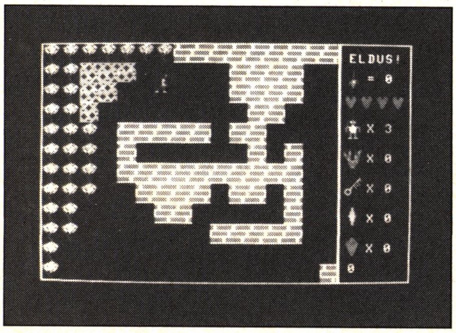
—Jerry Semones

Software

CoCo 3

Eldus— A Swimmer in the Pool of Life

Eldus is a one-player arcade Adventure in which you enter the realm of Barthen in search of a pool of life called "Eldus." Movement through the 101 screens is by way of a joystick. No, that was not a misprint; there really are 101 screens. So even the most jaded adventurist will either have to get paper and pencil to map his or her progress or be blessed with extraordinary memory.



Throughout the multitude of turns, doors and passages lie treasures in the form of coins, keys, gems and fire. You must gather 21 of these items to be allowed access to the well that holds the pool of life. Be advised that this world is infested with Wrelnins, rather slow-witted, bat-like creatures whose sole purpose is to impede your progress. While you are armed with a sword, it has no effect on the Wrelnins, which must be avoided because coming in contact with one shortens your life. Unlike the proverbial cat with its nine lives, you are allotted only three, but in each of these lives you can sustain a Wrelnin's sting eight times before you succumb.

Why bother having a sword if it has no effect, you ask? As it happens, there is a mirror-image sword hidden in this world, which when found enables you to shoot fireballs with your sword. Also, once you have located a fire, the sword has the power to burn certain items. You only need to find one fire to obtain the power, but you need all the fires to gain access to the well of life.

Your state of progress is continuously monitored and displayed on the right side of the screen. Your well-being is represented by four hearts. Each time a Wrelnin touches you, one-half of one heart is lost. So, gallant adventurer, "don't lose heart." The screen also shows a running total of all of the coins, keys, etc. that you have accumulated so far.

In order to enter this mythical world, you need a CoCo 3 with at least 128K of memory and a joystick. *Eldus* comes with three pages of documentation that includes a brief background story and adequate descriptions of the items and features found in the game. Operation is smooth and the graphics are crisp, if not detailed. But the recommended disk backup was impossible using the `BACKUP` and `COPY` commands. Some of the popular copying utilities proved equally fruitless in creating a backup copy. *Eldus* has a Pause feature, which allows you to take a breather and raid the 'fridge to build up strength before facing another room full of Wrelnins, but it does not have a Save feature. This does not present a problem because it is an arcade type of game, playing time is hardly ever long enough to really necessitate a game being saved.

Eldus is a fun game for young and old, and it doesn't require you to key in secret codes or spells, or try to figure out whether the author wanted you to `TAKE`, `BRING`, `GET` or maybe `USE` a certain item. And at a time when many programs are priced upwards of $20, it is good to see that *Eldus* costs a reasonable $16. It is a nice addition to anyone's software library.

(SPORTSware, 1251 S. Reynolds Road, Suite 414, Toledo, OH 43615, 419-389-1515; $16)

—George Aftamonow

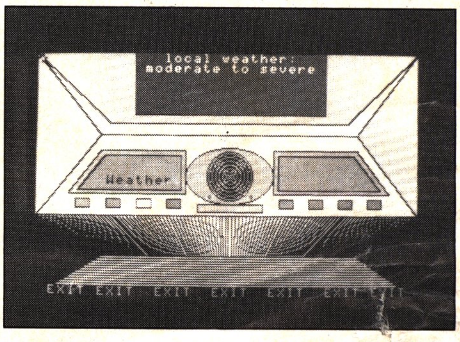
Software

CoCo 3

Tazman— Stock Markets in Space

Have you ever wanted to play the stock market or fly a ship through space? Here is an opportunity to do both. *Tazman*, written by Judith A. Emge and distributed by Eversoft Games Ltd, is a well-documented and user-friendly program that combines the lure of Wall Street with the unknown mysteries of planetary exploration.

Prepare your provisions prior to embarking on this journey. You'll need to bring the following: OS-9 Level II System and Config disks, a 512K CoCo 3 with disk drive and a joystick or mouse. Don't forget to pack your charts, a sharp pencil, a blank disk and plenty of time.



Before the appearance of Jans Hobart Tazman, a free trader, the Galactic Empire held a monopoly supplying goods and services throughout the galaxies. Tazman began recruiting others into the illegal but lucrative business of interstellar trade. Soon the Empire, more often than not, found itself being underbid at world trade centers.

As an attempt to reestablish galactic supremacy, the Emperor imposed heavy fines upon planets dealing in the new free market. A battle ensued when the Scarabian star system refused to acknowledge said fines. The combined forces of high-tech free trade ships and the Scarabian navy fought off a surprised Imperial Battle Fleet, paving the way for open trade. The Empire eventually fell, though not before leaving its wake of destruction and ruin upon the entire galaxy.

Years have passed and your world has once again become productive, but one problem remains — trade routes have been forgotten. Wondering if you have what it takes to be a "Tazman," you decide to quit your mundane job and start a new life as a greenhorn, a novice space trader.

You begin the game outside your newly acquired spaceship that is parked on one of the six worlds known to your ship's computer scanning device. You have a full tank of generic rocket fuel and $5000 of available funds. Your objective is to generate profits buying and selling commodities, at various world trade centers, that in turn will be used to purchase the most finely equipped starship technology has to offer.

How you achieve these ends depends on how well you chart and use the wealth of information presented. Some references are free, others can cost an arm and a leg. If you happen to run out of funds, a bank officer will gladly draw up a loan of $10,000 and raise your interest rate another percent.

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When seeking advice, stroll on into Dauntless Jane's, a planetary information depot that has valuable up-to-date information on planet distances, product locations and prices (this company must double as a travel agency). Keeping updated records prevents the need of paying for the same information twice. You will be billed a small fee for single product inquiries or larger fees for access into a planet portfolio. Make sure a product can be sold for profit on another planet before making a purchase. I hastily loaded my ship full of cargo that I couldn't sell anywhere in the current trade route and felt a moon migraine setting in as I hauled the dead weight through space.

It is entertaining, but unlike the fast-paced arcade-type games, *Tazman* keeps you busy figuring calculations, planning trade routes and repairing the ship — a practical lesson in commerce and organizational skills.

When you feel ready to invest your capital, enter the trade center. The stock exchange is a purple display with current buying and selling prices and quantities of each product in the warehouse. A chart is supplied with the program to keep track of stock market information. Prices fluctuate with the varying levels of production and consumption on each planet. Keep in mind the adage "buy low, sell high" or you'll end up back with the smiling bank officer. Plan a trade route carefully, possibly short hops to nearby planets, which saves on fuel costs. Keep in mind the need to use cargo space wisely.

The sub-compact ship you begin with is in immediate need of repair. It is recommended to pull on into the Repair Facilities, a space garage, from time to time. That ship you thought was such a good deal for a quarter of a million dollars actually needs major repairs. If you think she'll still fly, shop around because some planet repair facilities fix minor repairs for free. Don't trust the space mechanics' billing methods. Pay for partial repairs, then check to see if the remaining repairs are free.

If you plan to explore planets, tracker and communication devices should be high on your list of priorities. Some devices fetch prices upwards of 4 million dollars. Chart the upgrade equipment available at each Outfitter. Equipment offered varies on each planet.

Finding unknown planets, of which there are 50, is the most time consuming aspect of the game. You have to input coordinate or bearing variables into the ship's computer,then scan the area for planets. If a planet is located in the nearby vicinity, its location is displayed onscreen. It took me some time to land on unknown planets because of low-level equipment. As more planets are located on your trade route, profit margins and news updates broaden.

I became immersed in the game rather quickly. It is entertaining, but unlike the fast-paced arcade-type games, *Tazman* keeps you busy figuring calculations, planning trade routes and repairing the ship — a practical lesson in commerce and organizational skills. Attaining higher rank as a trader takes considerable patience. If you have just purchased the game, a target date in mid-spring would not be far off the mark.

(Eversoft Games Ltd., P.O. Box 3354, Arlington, WA 98223, 206-653-5263; $24.95 plus $2 S/H)

—Tony Olive

Software CoCo 1, 2 & 3

Arcade Action Packs Volumes 1 & 2— A Gallery of Games

I was very pleased to receive a review assignment from THE RAINBOW: I like writing and I *love* arcade games. I have been hooked on video games since a *Pong* machine was installed in Duquesne University's recreation center. (I missed most of my classes that day.)

Over the years I have collected several computers and video game machines, with the software to go with them. Perhaps this is why I find *Action Arcade Packs Volumes 1 & 2* from Christopher English Communications to be a bit disappointing.

There are two programs on each disk: *Laser Blitz* and *Kung-Fu* fighter on *Volume 1*, and *Pengy in Polarland* and *Pyramid Pete* on *Volume 2*. All are lackluster versions of programs we have seen before.

Although each program is different, they all share several characteristics that could be improved, such as irritating music and sound effects and overly long delays between play rounds. The volume control on my television took care of the first problem, but there is no way to skip the delays. I had to wait them out. Also, there are no game pause features for when family or nature calls.

The most original game presented is *Laser Blitz*, which, unfortunately, I liked the least. You must use a joystick to maneuver a pair of laser cannons — one horizontal, one vertical — to destroy cute little alien invaders as they descend upon your territory. The trick here is that your laser fire is only lethal where the beams intersect, giving the aliens ample opportunity to dodge.

Blitz suffers from a poor joystick routine that causes the cannons to be difficult to control. Since the BASIC code *Blitz* is written in is copy-protected, casual hackers cannot go into the program to write their own routines.

Kung-Fu Fighter is similar to most of the martial arts simulations so popular during the last few years. Your character must kick and punch his way past guards to rescue his grandmother from the evil Tao Yin Fa. If your energy runs out before you rescue your grandmother, the game ends.

Each punch or kick you throw in *Kung-Fu*, using the keyboard, hits your adversary if you are within range. Each blow has the same effect no matter which part of the body is hit. The guards have no real fighting style; they seem to throw punches and kicks at random. There is no ducking, dodging or punch blocking. A flurry of kicks and punches with an occasional back-step gets you past most of the guards.

The graphics of *Kung-Fu Fighter* appear to be created through the CoCo's `DRAW` command and are not appealing. All three versions of the Color Computer are capable of better.

After playing *Kung-Fu Fighter* for a while, I found that I didn't care if I reached Tao Yin Fa or not.

Volume 2 is a better value for your money. Both *Pengy in Polarland* and *Pyramid Pete* have nice graphics, although movement in *Pengy* is rather jerky.

In *Pengy* your job is to infiltrate the stronghold of the evil Munchers and destroy as many of them as you can by smashing them with blocks of ice. The survival of Peng-City depends upon your expertise at dispatching your adversaries.

As mentioned before, the graphics of *Pengy* are rather jerky. The characters seem to jump to new positions instead of flowing smoothly. The Pengy character is nicely animated, though.

Using either a joystick or the keyboard, you move your Pengy around the screen, avoiding Munchers until they are in position to be crushed by a giant ice cube. But you must hurry! New Munchers appear onscreen at intervals, and you have a limited amount of time to dispatch them all. Being touched by a Muncher or running out of time causes you to be turned into an Eskimo pie.

This game is rather dull at the lower levels of play. If you wait long enough, all of the munchers line up and allow you to destroy them with a single ice block. It is as the game progresses that *Pengy* becomes a challenge. The Munchers move faster and appear more frequently. There are also fewer ice blocks to hide behind. (Don't make the mistake of allowing all of the ice blocks to vanish before you defeat the Munchers.) I must admit *Pengy in Polarland* has begun to grow on me.

I wish a different color scheme had been used, though: The score and timer are impossible to read on my television set due to lack of contrast. Using the alternate Color mode on powering up the computer does not help.

There is also a totally useless high-score board that does not save to the disk. What is the point?

> **I liked *Pyramid Pete* the most of the four programs because of the nice graphics and responsive joystick control.**

Pyramid Pete is a standard *Q-bert* clone with no surprises. You must use your joystick to move Pete up and down a pyramid-shaped stack of boxes in order to change the color of each box. Pete is pursued by various bad guys, whose sole intent is to stop Pete.

I liked *Pyramid Pete* the most of the four programs because of the nice graphics and responsive joystick control. However, *Pete* has one feature I can definitely do without. One of the bad guys, the Changeling, has the obnoxious habit of jumping onto boxes Pete has already landed on and changing them back to the base color. Maddening!

The documentation accompanying the games consists of several photocopied sheets featuring computer-printed graphics. They suffer from minor errors in the loading instructions, poor spelling and awkward grammar.

A nice feature of the documentation is the folksy letters to the consumer that Mr. English has written. In these letters he tells us a bit about how each program was written and some of his plans for the future.

In a way, the *Action Arcade Packs* chronicle Mr. English's progress as a game programmer. He definitely gets better as he goes along.

Action Arcade Pack Volume 1 will run on any Color Computer with at least 64K. *Action Arcade Pack Volume 2* requires a Color Computer 3 and a joystick.

(Christopher English Communications, 40-25 College Point Blvd., #8G, Flushing, NY 11354, 718-445-6589; $9.95 plus $3 S/H per disk)

—James J. Walton, Jr.

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"Toronto, Ontario" for a Basket

by Steve Blyn
Contributing Editor

This month's article is an expansion of last month's educational math drill program. I have converted the same program to accept data statements, which enables us to enter material in the areas of language arts, social studies and science. To demonstrate a new version of the program, I have chosen a Canadian provinces-and-capitals game.

The program's basketball shell portion remains the same as last month. The strength of this program is that it is usable with a variety of subject matter. All of the program lines, up to and including Line 170, are the same as last month. You do not need to retype these lines if you typed in last month's program. If you have last month's program, simply load it and type `DEL 180-` and press ENTER. This deletes Line 180 and those following it, leaving you with all of the lines from 10 through 170. You need to type in only the remainder of this month's program. When you save your work this month, you will have two complete versions of the basketball program.

The only difference in the beginning portion of the two versions is that Line 15 must be added to this month's program. This is because there are data statements to be read in and used by the computer. Line 15 sets up the dimension of the data (12 pairs in this case) and reads them into the program. When you want to input different data, simply adjust the value of Variable `M` on Line 15 to alert the computer to the amount of data.

The data is entered at the end of the program. I chose to enter three pairs of data statements for each program line. This was done to make proofreading for typing mistakes easier. You can actually enter up to 255 characters on any data line, but I have found from experience that this often gets confusing to proof or edit.

I included two additions to the original game: a timer and an ending score. The timer serves to keep the game moving along smoothly. Too often, students just stare at a question they cannot answer. The timer is set for 20 seconds; if no answer is entered during that time period, the answer is considered to be incorrect and the program proceeds. The timer is contained in lines 200 through 230. Each second is approximately 60 points on the computer's internal timer. Therefore, 20 seconds has a value of about 1200 (60*20) on the timer. If you want to alter the timer, change the value of Variable `K` on Line 210.

The other change is a score limit that ends the game. I chose a score of 20 points to be a logical ending. Whether the player or the computer receives a score of 20, the round is considered at an end. The variables `A` and `B` on Line 180 control this feature. You can of course lengthen the game by raising these numbers. You can also eliminate this feature altogether by not typing in the last portion of the line that begins with the `IF` statement.

After each round is over, the player can begin another round by pressing ENTER, or end the program by pressing E. Please feel free to make any modifications. ❑

Steve Blyn teaches both exceptional and gifted children, holds two master's degrees, and has won awards for the design of programs to aid the handicapped. He owns Computer Island and lives in Staten Island, New York.

16K Extended

50	217
120	26
180	196
250	254
310	218
360	2
END	78

The Listing: `BASKETBL`

```
10 REM"THE BASKETBALL CAPITOL'S
DRILL- STEVE BLYN,COMPUTER ISLAN
D,STATEN ISLAND,NY,1989"
15 M=12:DIM A$(M),B$(M):FOR T=1
TO M:READ A$(T),B$(T):NEXT T:REM
" *** THIS IS A NEW LINE"
30 FOR X=1377 TO 1383:POKE X,172
:NEXT X
40 FOR X=1400 TO 1406:POKE X,172
:NEXT X
50 FOR Y=1156 TO 1348 STEP 32:PO
KE Y,239:NEXT Y
60 FOR Y= 1179 TO 1371 STEP 32:P
OKE Y,239:NEXT Y
70 FOR X=2 TO 16:FOR Y=0 TO 7:SE
T(X,Y,8):NEXT Y,X:POKE 1060,191
80 FOR X=47 TO 61:FOR Y=0 TO 7:S
ET (X,Y,8):NEXT Y,X:POKE 1083,19
1
90 PRINT@99,"000";:PRINT@122,"00
0";
100 POKE 1196,223:POKE 1203,197
110 FOR Y=1228 TO 1296 STEP 32:P
OKE Y,218:NEXT Y
120 POKE 1323,214:POKE 1354,214:
```

```
POKE 1324,221:POKE 1357,217
130 POKE 1260,222:POKE 1229,214:
POKE 1259,214:POKE1290,212
140 FOR Y=1204 TO 1300 STEP 32:P
OKE Y,202:NEXT Y
150 POKE 1331,198:POKE1362,198:P
OKE 1332,205:POKE 1365,201
160 POKE 1268,206:POKE 1237,198:
POKE 1206,194
170 POKE 1267,204:POKE 1234,201:
POKE 1201,193
180 P=RND(M):PRINT@416,A$(P);"'S
 CAPITOL":IF A=20 OR B=20 THEN 3
30 ELSE 190
190 PRINT@448,"":PRINT@448,"IS..
. ";:POKE1199,148:REM-THE BALL
200 TIMER=0:K=TIMER:REM 20 SECON
D TIMER
210 K=TIMER:IF K>1200 THEN PRINT
@454,"TIME IS UP":PLAY"L4D-D-D-"
:GOTO 260
220 EN$=INKEY$
230 IF EN$="" THEN 210
240 LINEINPUT DD$:REM-STUDENT'S
ANSWER
250 IF DD$=B$(P) THEN 290 ELSE 2
60
260 FOR Y=1199 TO 1080 STEP-30:
POKE Y,148:SOUND 230,2:POKE Y,12
8:NEXT Y
270 FOR T=1 TO 3:POKE 1083,239:P
LAY"L10A":POKE 1083,191:PLAY"G":
NEXT T:B=B+2:PRINT@122,B;
280 PRINT@454,B$(P):GOTO 310
290 FOR Y=1199 TO 1080 STEP-34:P
OKE Y,148:SOUND 230,2:POKE Y,128
:NEXT Y
300 FOR T=1 TO 3:POKE 1060,239:P
LAY"L10F":POKE 1060,191:PLAY"F":
NEXT T:A=A+2:PRINT@99,A;
310 EN$=INKEY$
320 IF EN$=CHR$(13) THEN 180 ELS
E IF EN$="E" THEN 350 ELSE 310
330 PRINT@416,STRING$(64,255)::P
RINT@422,"THIS ROUND IS OVER";:P
LAY"L20GFEDCCC"
340 EN$=INKEY$:IF EN$=CHR$(13) T
HEN RUN ELSE IF EN$="E" THEN 350
 ELSE 340
350 CLS:END:REM ***THE NEW DATA
BEGINS HERE
360 DATA ALBERTA,EDMONTON,BRITIS
H COLUMBIA,VICTORIA,MANITOBA,WIN
NIPEG
370 DATA NEW BRUNSWICK,FREDERICK
TON,NEW FOUNDLAND,ST.JOHN'S,NORT
HWEST TERRITORIES,YELLOWKNIFE
380 DATA NOVA SCOTIA,HALIFAX,ONT
ARIO,TORONTO,PRINCE EDWARD IS.,C
HARLOTTETOWN
390 DATA QUEBEC,QUEBEC CITY,SASK
ATCHEWAN,REGINA,YUKON TERRITORY,
WHITEHORSE
```

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Battling the evil Swordmaster on the CoCo

SA

by Steve Britton

The samurai master quietly mutters an ancient prayer as you descend into the darkness of the cave and enter the multi-level dungeon of the evil Swordmaster. If you survive the first eight levels of the twisty caverns, each filled with evil creatures, and kill the Swordmaster, you earn the rank of samurai.

The Game

You are the man in the upper left corner of the screen with your sword drawn (represented by /). To move around, use the arrow keys; to swing your sword, press the space bar. You will notice several gold blocks within each level. These are gold bars and are worth 100 points each. There is also a black-and-gold block near the center of the screen in levels 1 through 4. To get past a door, you must have a score of at least 500 points for each previous level. For example, to get past a door on Level 3, you must have at least 1500 points.

As you travel through the dungeon, monsters jump out from the shadows before you and start running toward you. In order to kill these monsters, you must swing your sword at just the right time. If you hit a monster, you receive a certain amount of points, depending on the monster you hit. If you miss, your strength is partially drained. If your strength reaches 0, you are dead. The lower the level you are traveling in, the more powerful the monsters are and the more strength they can drain from you.

Every time you swing your heavy sword, your energy goes down. The amount of energy you have left is represented by the word `SWING` at the lower right corner of the screen (along with strength and score indicators). If your swing power reaches 0, you won't have enough energy to swing your sword until you either get to the next level or step into an energy chamber (located at the top of the screen near the middle). Each time you step into an energy chamber while your swing power is at 0, your swing power is increased to 1. But the energy chambers are not unlimited in their power supplies, so use them wisely.

To descend to a deeper level, you must get to the pit at the lower left of the screen. Every time you go down a level, you are awarded more strength. The amount you gain depends on your score at that point in the game.

The last four levels are shaped differently from the first four. You will notice that there are not any doors or energy chambers on these levels. You must be careful with your swinging power — once you run out, that's it until the next level.

Another difference you will notice is that there doesn't appear to be a pit leading to the next level. This is because on each of these levels you must find a secret door that leads to the pit. In order to find these doors, you must first have a key. To obtain a key on a certain level, as with opening a door in the upper levels, you must have a score of at least 500 points per previous level. For example, on Level 6 you must have at least 3000 points to obtain a key. If you possess a key, the center of the screen at the bottom displays the word `KEY`. Once you have the key, you must search that level for the secret door.

To search a certain portion of the wall, move beside that area (or over it, under it,

Steve Britton is a self-taught programmer who has worked with the CoCo for over six years. He can be contacted at Rt. 2, Box 1015, Friendsville, TN 37737; (615) 995-2034.

16K Extended

8	163
18	189
33	17
45	250
58	176
71	119
79	186
95	103
102	30
114	253
119	178
127	144
131	190
END	110

The Listing: `SAMURAI`

```
0 'COPYRIGHT 1989, FALSOFT INC.
1 SOUND255,1:FORWW=1TO5:CLS:PRIN
T@15,"'/";:FORX=1TO25:EXEC43350:
NEXTX:PRINT@15,"'-";:FORX=1TO100
:NEXTX:PRINT@15,"\'";:FORX=1TO10
0:NEXTX:PRINT@15,"-'";:FORX=1TO1
00:NEXTX:NEXTWW
2 SOUND25,10:SOUND90,10:SOUND25,
6:FORX=1TO250:NEXTX:SOUND25,3:SO
UND90,15:SOUND25,5
3 PRINT@106,"*** SAMURAI ***":PR
INT@131,"A STEVE BRITTON PRODUCT
ION":PRINT@204,"GET READY..."
```

MURAI

etc.) and press S for search. If nothing happens, that is not the correct area and you must search somewhere else. If a new group of tunnels appears along with the pit, you've found it!

Fighting the Evil Swordmaster

Once you have penetrated the first eight levels of blood-thirsty monsters, wielding a heavy sword and searching for secret doors, you must face the evil Swordmaster, keeper of the dungeon. The screen shows you on the left, standing with your trusty sword drawn, and the Swordmaster on the right. Both of you are in his throne room. The fight starts when you take the first swing by pressing the space bar. Then all you can do is press the space bar as fast as you can, hoping to drain all of his strength before he drains all of yours.

The CoCo keeps track of hits and misses, reporting results directly under the fighting area. If the word `BLOCKED` appears under you, you have blocked a swing thrown by the Swordmaster. If you see `HIT HIM` under you, you have hit the Swordmaster and drained some of his strength. The same goes for what appears beneath the Swordmaster except when he hits you, the screen reads `HEH HEH!`.

Helpful Hints

The closer you are to a wall on the right side, the less chance there is that a monster will jump out. If you want monsters to jump out so you can gain more points, get as far to the left of a wall as you can.

Score as many points as you can on each level in order to decrease your chances of being trapped on one of the lower levels without swing power or a key. (In such a case, you might consider hara-kiri.)

Just type `(C)LOAD"SAMURAI"` to load the program. "Beware!" the samurai master warns, "Your strength and energy have their limits!" ❑

```
4 FORWW=1024TO1535:P=PEEK(WW):IF
P=>64THEN POKEWW,P-64
5 NEXT WW
6 L=1:SC=0:E=RND(5)+10
7 GOTO86
8 SW=RND(20)
9 J=1
10 K=32:IFL=1THEN12
11 ST=ST+INT(SC/500)
12 RESTORE
13 FORT=1TO27 :READX,Y:FORA=X TO
 Y:PRINT@A," ";:NEXTA,T
14 DATA33,61,69,70,99,103,130,13
5,163,167,11,12,75,76
15 DATA26,28,90,92,80,81,213,214
,112,113,143,146,177,191,149,150
,155,159,219,223
16 DATA254,255,282,287,291,315,2
32,243,264,278,328,342,360,374,3
23,324,355,356,387,388
17 PRINT@160+26,CHR$(138+16);:PR
INT@54,CHR$(143+16);:PRINT@132,C
HR$(143+16);:PRINT@235,CHR$(143+
16);:PRINT@419,CHR$(131);:PRINT@
420,CHR$(131);:PRINT@10,"x  x";
18 M$="'/":PRINT@33,M$;:YU=33:YP
=1057:PRINT@137,"level";:POKE119
5,48+L:EXEC44539
19 PRINT@YU,M$;:Q=RND(50-(L*3)):
IFQ=<3THEN47ELSEYP=YU+1024:PRINT
@YU,M$;:A$=INKEY$
20 IFA$=CHR$(9)THEN32
21 IFA$=CHR$(8)THEN36
22 IFA$=CHR$(10)THEN38
23 IFA$=CHR$(94)THEN42
24 IFA$="S"ANDKY=1THEN109
25 IFA$=" "ANDSW>0THEN45
26 PRINT@416+21,"score";SC;
27 PRINT@448+21,"swing";SW;
28 PRINT@384+20,"strength";ST;
29 IFSC>=L*500ANDL<=4THENPRINT@1
86," ";
30 IFSC>=L*500ANDL>=5THENPRINT@4
58,"key";:KY=1
31 GOTO19
32 P=PEEK(YP+2):IFP<>96THEN78
33 PRINT@YU," ";:YU=YU+1:M$="'/"
:J=J+1
34 IFPEEK(YP+2)=149THENSC=SC+200
35 GOTO19
36 IFPEEK(YP-1)<>96THEN80
37 YU=YU-1:M$="\'":J=J-1:PRINT@Y
U+2," ";:GOTO19
38 P=PEEK(YP+32):IFP<>96THEN82
39 IFPEEK(YP+33)<>96THEN19ELSEPR
INT@YU,"  ";:YU=YU+32:K=K+32
40 IFPEEK(YP+32)=149THEN SC=SC+2
00
41 GOTO19
42 P=PEEK(YP-32):IFP<>96THEN84
43 IFPEEK(YP-31)<>96THEN19ELSEPR
INT@YU,"  ";:YU=YU-32:K=K-32:IFY
U=11ANDSW=0ANDE>0THEN SW=SW+1:E=
E-1
44 GOTO19
45 IFM$="'/"THEN PRINT@YU+1,"-";
:FORX=1TO10:EXEC43350:NEXTX:FORX
=1TO100:NEXTX:SW=SW-1:PRINT@448+
26,SW;:GOTO19
46 PRINT@YU,"-";:FORX=1TO10:EXEC
43350:NEXTX:FORX=1TO100:NEXTX:SW
=SW-1:PRINT@448+26,SW;:GOTO19
47 IFK+(J+7)>K+32 THEN19
48 Q=RND(4)+3:FORX=YP+2TOYP+Q:IF
PEEK(X)<>96THEN19ELSENEXTX
49 SOUND255,2
50 IFPEEK(YP+Q)<>96THEN19ELSETM=
RND(3+L):ON TM GOTO51,52,53,54,5
5,56,57,58,59,60,61
51 TM=42:GOTO62
52 TM=31:GOTO62
53 TM=45:GOTO62
54 TM=60:GOTO62
55 TM=43:GOTO62
56 TM=39:GOTO62
57 TM=46:GOTO62
58 TM=40:GOTO62
59 TM=44:GOTO62
60 TM=62:GOTO62
61 TM=34:GOTO62
62 FORMA=YP+(Q-1) TO YP+1STEP-1
63 PRINT@448+26,SW;
64 IFM$="\'"THEN M$="'/"
65 FORX=1TO100:NEXTX:POKEMA,TM:P
OKEMA+1,96
66 IFINKEY$=" "ANDSW>0THENPRINT@
YU,"'-";:FORX=1TO10:EXEC43350:NE
XTX:SW=SW-1
67 IFPEEK(MA-1)=109THEN FORX=1TO
5:SOUND89,1:NEXTX:PRINT@YU,"'/ "
;:SC=SC+TM:GOTO19
68 PRINT@YU,"'/";:NEXTMA
```

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```
69 IFPEEK(MA)=96THENPOKEMA+1,96:
GOTO19
70 ST=ST-RND(L+1):POKEMA+1,96:IF
ST>0THEN19
71 CLSRND(8):PRINT@202,"YOU'VE B
EEN";:PRINT@234,"KILLED IN";:PRI
NT@266,"THE DUNGEONS";:PRINT@301
,"OF";:PRINT@325,"THE EVIL SWORD
MASTER !!";
72 FORZZ=1024TO1535:P=PEEK(ZZ):I
FP>=64THENPOKEZZ,P-64
73 NEXTZZ
74 SOUND1,10:FORX=1TO10:NEXT:SOU
ND1,5:SOUND70,20:FORX=1TO50:NEXT
:SOUND1,10:SOUND70,5:SOUND110,15
:FORX=11TO1STEP-11:SOUNDX,3:NEXT
:SOUND1,30:CLS
75 PRINT@74,"score:";SC
76 PRINT@480,"hit any key":EXEC4
4539
77 RUN
78 IFPEEK(YP+2)=159THEN SC=SC+10
0:GOTO33
79 GOTO19
80 IFPEEK(YP-1)=159THEN SC=SC+10
0:GOTO37
81 GOTO19
82 IFYU=387THEN L=L+1:GOTO7
83 GOTO19
84 IFYU=308THEN L=L+1:GOTO7
85 GOTO19
86 ONL GOTO 87,88,89,90,91,92,93
,94,95
87 CLS5:ST=18:GOTO8
88 CLS6:GOTO8
89 CLS8:GOTO8
90 CLS7:GOTO8
91 CLS4:GOTO99
92 CLS6:GOTO99
93 CLS3:GOTO99
94 CLS0:GOTO99
95 IFZZ<1061THEN119ELSECLS0:PRIN
T@40,"congratulations";:PRINT@76
,"samurai";:FORX=1216TO1246:POKE
X,39:POKEX+1,47:FORT=1TO10:EXEC4
3350:NEXTT:POKEX+1,32:POKEX+1,45
:FORT=1TO75:NEXTT:POKEX,32:NEXTX
:POKEX-1,39
96 SOUND100,5:SOUND130,2:FORX=1T
O20:NEXT:SOUND130,9:SOUND151,5:F
ORX=1TO20:NEXT:SOUND151,5:SOUND1
79,2:FORX=1TO10:NEXT:SOUND179,30
97 PRINT@267,"score";SC;:PRINT@4
80,"hit";CHR$(128);"any";CHR$(12
8);"key";:EXEC44539
98 RUN
99 RESTORE:FORX=1TO27:READY,Z:NE
XTX:FORT=1TO14  :READX,Y:FORA=X
TO Y:PRINT@A," ";:NEXTA,T
100 DATA1,15,54,63,86,88,117,119
,78,81,109,114,130,147,172,182,2
05,210
101 DATA258,273,290,305,359,362,
354,356,386,388
102 FORX=1TO3:READR,T:FORA=R TO
T STEP32:PRINT@A,"  ";:NEXTA,X
103 DATA34,324,149,149,328,392
104 PRINT@238,"    ";:PRINT@334,
"    ";:PRINT@31," ";:PRINT@95,"
 ";
105 SW=RND(20):KY=0:J=2:K=384:ST
=ST+INT(SC/500)
106 PRINT@15,CHR$(143+16);:PRINT
@140,CHR$(143+16);
107 M$="'/":PRINT@386,M$;:YU=386
:YP=1410:PRINT@38,"level";:POKE1
096,48+L
108 GOTO19
109 ON L GOTO110,110,110,110,110
,111,112,113
110 IFYU=181THEN114ELSE 19
111 IFYU=336THEN116ELSE 19
112 IFYU=392THEN117ELSE19
113 IFYU=59THEN118ELSE19
114 PRINT@183,"         ";:FORX=
219TO347STEP32:PRINT@X,"     ";:
NEXTX:PRINT@342,"          ";:
FORX=276TO340STEP32:PRINT@X,"  "
;:NEXTX:PRINT@317,CHR$(143+16);
115 PRINT@276,CHR$(140)+CHR$(140
);:GOTO19
116 PRINT@368,"     ";:FORX=276T
O340STEP32:PRINT@X,"  ";:NEXTX:P
RINT@373,CHR$(143+16);:GOTO115
117 PRINT@424,"          ";:FOR
X=276TO372STEP32:PRINT@X,"  ";:N
EXTX:PRINT@401,"   ";:PRINT@370,
"  ";:GOTO115
118 FORX=91TO155STEP32:PRINT@X,"
  ";:NEXTX:PRINT@152,"  ";:PRINT
@152+32,"  ";:PRINT@216,"      "
;:PRINT@154," ";:FORX=222TO382ST
EP32:PRINT@X,"  ";:NEXTX:PRINT@3
74,"         ";:FORX=276TO372STEP
32:PRINT@X,"  ";:NEXTX:GOTO115
119 SM=18:CLS:PRINTTAB(12)"NOW F
ACE":PRINT@46,"THE":PRINT@77,"*E
VIL*":PRINT@105,"*SWORD MASTER*"
120 FORZZ=1024TO1151:P=PEEK(ZZ):
IFP>=64THEN POKEZZ,P-64
121 NEXTZZ
122 SOUND125,4:SOUND149,9:SOUND1
25,2:SOUND136,5:SOUND149,25
123 CLS:FORX=1024TO1535:POKEX,32
:NEXTX
124 POKE1312+12,39:POKE1312+16,3
4
125 POKE1344+12,24:POKE1344+16,2
4:POKE1376+12,46:POKE1376+13,46:
POKE1376+16,46:POKE1376+15,46
126 PRINT@448,"strength";ST;:PRI
NT@464,"strength";SM;
127 FORX=1416TO1432:POKEX,45:NEX
TX:POKE1415,47:POKE1433,28:POKE1
446,47:POKE1466,28
128 FORX=1088TO1248STEP34:POKEX,
28:NEXTX:FORX=1119TO1248STEP30:P
OKEX,47:NEXTX:FORX=1225TO1239:PO
KEX,45:NEXTX:FORX=1248TO1376STEP
32:POKEX+8,58:NEXTX
129 FORX=1248TO1376STEP32:POKEX+
24,58:NEXTX:POKE1224,32:FORX=106
7TO1077:POKEX,45:NEXTX:FORX=1099
TO1132STEP33:POKEX,28:NEXTX:FORX
=1109TO1140STEP31:POKEX,47:NEXTX
:FORX=1165TO1171:POKEX,45:NEXT
130 PRINT@456,ST;:PRINT@472,SM;:
EXEC44539:FS=RND(2):ON FS GOTO13
1,134
131 A$=INKEY$:IFA$=" " THEN POKE
1357,32: POKE1358,45:DB=RND(3):I
FDB<3THEN POKE1359,40:PRINT@432,
"blocked";:POKE1357,32:POKE1358,
32:POKE1357,47:FORX=1TO250:NEXTX
:FORX=1456TO1465:POKEX,32:NEXTX:
POKE1359,32:RD=4:GOTO134
132 IFA$<>" "THEN134
133 PRINT@424,"hit";:POKE1451,32
:PRINT@428,"him";:FORX=1TO250:NE
XTX:FORX=1447TO1455:POKEX,32:NEX
TX:SM=SM-RND(4):POKE1358,32:POKE
1357,47:IFSM<=0THEN95 ELSE134
134 C$="^"
135 IFRND(3)<3THENPRINT@424,"blo
cked";:POKE1357,41:POKE1359,32:P
OKE1358,45:FORX=1TO250:NEXTX:FOR
X=1447TO1455:POKEX,32:NEXTX:POKE
1358,32:POKE1359,28:GOTO130
136 PRINT@432,"heh";:POKE1459,32
:PRINT@436,"heh";:POKE1463,33:PO
KE1357,32:POKE1358,45:FORX=1TO25
0:NEXTX:FORX=1456TO1465:POKEX,32
:NEXTX:ST=ST-1:POKE1358,32:POKE1
359,28:IFST<=0THEN71
137 GOTO130
```

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Carte Blanche

A program that lets you build menus on BASIC09 programs

by Richard Ries

After struggling with building windows for another program, I wrote a program to make life easier. The program became several programs and the result is *Carte Blanche.*

Procedure `main` is a test stub to show you how `menu` can be used. `menu` takes the information gathered by `bldmenu` and uses it to make the overlay windows, print the menu selections, and get the user's response. It also checks the keyboard and the mouse/joystick. The up and down arrow keys and the vertical movements of the mouse/joystick can be used to scroll through the selections. Pressing a button on the mouse/joystick or the ENTER key on the keyboard exits `menu` with the selection code. Pressing any other key on the keyboard returns that key's value to the calling routine — in this case, `main`. This is to allow selection by single letter as well as by point-and-click methods.

Richard Ries is an embedded-systems programmer working for a Long Island firm. His Delphi username is RRIES; his CompuServe ID is 76057,3534. He may be contacted at 361 Deauville Blvd., Copiague, NY 11726.

Program Operations

After typing in and saving the programs, run `main`. There is a sample data file included, called `test` (Listing 3), which `main` uses. `main` is a sample program that shows you how `menu` can be called. It calls `menu`, passing it the name of the menu data file and two dummy parameters for `menu` to use. Based on what is returned, `main` changes the colors of the screen and then prompts you for input. The line marked `switch/case` shows BASIC09's equivalent to the `switch/case` statement in C. In fact, it's a little better because while C can deal with digits and single characters, the `SUBSTR` function works with strings of characters.

Three parameters are passed to `menu`: `name` and two dummies, `word` and `selection`. Dummy parameters are used to pass information back to the calling routine, `main`, which opens the `name` descriptor file and reads the information contained therein. Using that information, it tries to make an overlay window. I say tries because attempting to open a 60-character window on a 40-character screen produces a beautiful crash. Success, however, produces a menu with your choices displayed. The choice highlighted in reverse video is the current selection. Use the mouse/joystick and/or keyboard arrow keys to scroll through the choices. Going beyond the first or last selection produces a wraparound effect to the last or first choices, respectively. (Try it; it's easier to see than write.)

Pressing a button or key exits the menu and returns you to `main`, which responds to your choice. Remember that the button and ENTER key tell `menu` to use the highlighted selection. Pressing R, G, Y or W also returns a valid answer in this case. Any

Listing 1: `Carte_Blanche`

```
PROCEDURE main
 0000      DIM word,reply:STRING[1]
 0010      DIM selection,fcolor,bcolor:INTEGER
 001F
 0020      fcolor=0
 0027
 0028      REPEAT
 002A 1
 002E        selection=0
 0035        RUN menu("Test",word,selection)
 004B        IF selection=0 THEN
 0057          selection=INT(SUBSTR(word,"RrYyGgWw")/2+.5) \(* ~ switch/case
 0087        ENDIF
 0089        ON selection GOTO 2,3,4,5
 00A0        GOTO 1
 00A4 2      (* Red
 00AD        bcolor=1
 00B4        GOTO 6
 00B8 3      (* Yellow
 00C4        bcolor=3
 00CB        GOTO 6
 00CF 4      (* Green
 00DA        bcolor=2
 00E1        GOTO 6
 00E5 5      (* White
 00F0        bcolor=7
 00F7 6
 00FB        RUN gfx2("COLOR",fcolor,bcolor)
 0112        RUN gfx2("CLEAR")
 011F        PRINT "Press [ENTER] to repeat, any other key to end."
 0151        REPEAT
 0153          RUN inkey(reply)
 015D        UNTIL reply<>""
 0168      UNTIL reply<>CHR$(13)
 0174      END
 0176
PROCEDURE menu
 0000      PARAM name:STRING; word:STRING[1]; selection:INTEGER
 0018      TYPE registers=cc,a,b,dp:BYTE; x,y,u:INTEGER
 003D
 003E      DIM xstart,ystart,xlen,ylen,fcolor,bcolor,scolor,menu,du,ptr,res,han
d,mousey:INTEGER
 0075      DIM shadow,mickey:BOOLEAN
 0080      DIM choice(24):STRING[80]
 0091      DIM reg:registers
 009A      DIM title,bar:STRING[80]
 00AA
 00AB      ON ERROR GOTO 10
 00B1      RUN gfx2("CUROFF")
 00BF      OPEN #menu,name:READ
 00CB      INPUT #menu,title,xstart,ystart,xlen,ylen,fcolor,bcolor,scolor,shado
w,mickey,res,hand
 0101
 0102      (* get menu choices
 0115      FOR du=1 TO ylen-2
 0129        INPUT #menu,choice(du) \(* I$readln
 0142      NEXT du
 014D
 014E      CLOSE #menu
 0154
 0155      (* just in case...
 0167      res=LAND(res,$0100)
 0173      hand=LAND(hand,1)
 017E
 017F      (* do shadow box
 018F      IF shadow=TRUE THEN
 019A        RUN gfx2("OWSET",1,xstart+2,ystart+1,xlen,ylen,scolor,scolor)
 01CC      ENDIF
 01CE      RUN gfx2("OWSET",1,xstart,ystart,xlen,ylen,fcolor,bcolor)
 01FC
 01FD      (* print choices
 020D      PRINT
 020F      RUN gfx2("REVOFF")
 021D      FOR ptr=1 TO ylen-2
 0231        PRINT "   "; choice(ptr)
 023F      NEXT ptr
 024A
 024B      (* do header
 0257      du=INT((xlen-LEN(title))/2)
 0269      RUN gfx2("CURHOME")
 0278      RUN gfx2("REVON")
 0285      IF du<>0 THEN
 0291        FOR ptr=1 TO du
 02A2          PRINT " ";
 02A8        NEXT ptr
 02B3      ENDIF
 02B5      PRINT title;
```

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other key produces an error and `main` simply loops back to try again.

Three routines are used by `menu` in its quest for information. The first, `inkey`, comes supplied with Level 2 BASIC09. `joykey` and `mouse` are subroutines to read the joystick and mouse ports.

To read the vertical movement of the joystick, `joykey` uses `syscall` from the Level 2 package. At the beginning of `joykey`, the variable `hand` gets exclusively `OR`'d (`XOR`'d) with 1. The `XOR` operation changes a 0 to 1, and a 1 to 0. This is done because the `hand` number for the mouse is opposite that of the joystick. The routine ignores motion near the center of the joystick to allow for nervous users and vagaries in the joystick's centering. `joykey` returns a code to the calling routine to indicate whether or not a change is requested.

To read the mouse port, `mouse` also uses `syscall`. It also decides if the mouse has moved sufficiently since the last reading to warrant a change code being sent. This is to keep the mouse from hopping around like its real-life namesake.

Building Your Own Menus

When you want to define your own windows, run `bldmenu` and answer its questions. The first thing it asks for is the file path for the menu data. This allows you to have several menus called up from the current directory or from a separate directory. (Make sure the other directory exists, or the program will bomb later on.) The next thing it asks for is a title. This is the name that appears on the first line of the menu. It asks for the upper left hand coordinates, the length of the window in characters (add two for margins) and the length in lines. Again add two to the number of lines: one for the header and one for a bottom margin. `bldmenu` then asks what foreground and background colors you want and if you want a shadow box. Shadow boxes are one-color boxes the same size as the menu box, but offset one character down and to the right. If you want one, `bldmenu` asks what color it should be.

The next series of questions deals with the hardware. The first question is whether or not you are using a mouse and, if so, whether you are using the high-resolution adapter. Finally, you are asked which port you are using, left or right. The file is then created and you are prompted to type in the selections for the menu. After all this is done, the file is closed and a reminder is printed about how to use `menu`.

Of course, you'll have to write your own version of `main` to deal with calling `menu` and its answers.

If you're pressed for space, pack `menu`, `mouse` and `joykey` into a file called `menutmp`.

```
 02BB       IF du<>0 THEN
 02C7         du=du+LEN(title)+1
 02D7         FOR ptr=du TO xlen
 02E9           PRINT " ";
 02EF         NEXT ptr
 02FA       ENDIF
 02FC       RUN gfx2("REVOFF")
 030A
 030B       SHELL "tmode -echo"
 031A       ptr=1
 0321       bar=LEFT$("(enter 79 spaces between the quotation marks)",xlen-1)
 037E       REPEAT
 0380         (* set up bar
 038D         RUN gfx2("CURXY",1,ptr)
 03A2         RUN gfx2("REVON")
 03AF         PRINT bar;
 03B5         RUN gfx2("CURXY",3,ptr)
 03CA         PRINT choice(ptr);
 03D3         RUN gfx2("REVOFF")
 03E1         RUN gfx2("CURXY",1,ptr)
 03F6
 03F7         word=""
 03FE         REPEAT
 0400           RUN inkey(word)
 040A           IF word="" THEN
 0416             IF mickey=TRUE THEN
 0421               RUN mouse(res,hand,mousey,word)
 043A             ELSE
 043E               RUN joykey(word,hand)
 044D             ENDIF
 044F           ENDIF
 0451         UNTIL word<>""
 045C         RUN gfx2("EREOLINE")
 046C         PRINT "  "; choice(ptr);
 047A
 047B         IF word=CHR$($0A) THEN  \(* down- arrow
 0497           ptr=ptr+1
 04A2           word=""
 04A9           IF ptr>ylen-2 THEN  \(* wrap around
 04C7             ptr=1
 04CE           ENDIF
 04D0         ENDIF
 04D2         IF word=CHR$($0C) THEN  \(* up- arrow
 04EC           ptr=ptr-1
 04F7           word=""
 04FE           IF ptr<1 THEN  \(* wrap around
 0518             ptr=ylen-2
 0523           ENDIF
 0525         ENDIF
 0527       UNTIL word=CHR$(13) OR word<>"" \(* C/R or other character
 0553       selection=ptr
 055B 10    (* Exit routine
 056D       IF shadow=TRUE THEN
 0578         RUN gfx2("OWEND")
 0585       ENDIF
 0587       RUN gfx2("OWEND")
 0594       RUN gfx2("CURON")
 05A1       SHELL "tmode echo"
 05AF       END
 05B1

PROCEDURE mouse
 0000       PARAM res,hand,mousey:INTEGER; word:STRING[1]
 001A       TYPE registers=cc,a,b,dp:BYTE; x,y,u:INTEGER
 003F       DIM reg:registers
 0048       DIM dsa(32):BYTE
 0054       DIM du:INTEGER
 005B
 005C       (* set up mouse
 006B       reg.a=0
 0076       reg.b=$94 \(* ss.gip
 008B       reg.x=LOR(res,hand) \(* high/low res;right/left hand port
 00BF       reg.y=$FFFF \(* don't change key- repeat
 00E6       RUN syscall($8E,reg) \(* I$SetStt
 00FF
 0100       reg.a=0
 010B       reg.b=$89 \(* ss.mouse
 0122       reg.x=ADDR(dsa)
 0130
 0131       word=""
 0138       RUN syscall($8D,reg) \(* I$GetStt
 0151       du=dsa(27)*256+dsa(28)
 0165       IF du>mousey+2 THEN  \(* leeway
 017E         word=CHR$($0A)
 0187         mousey=du
 018F       ELSE
 0193         IF du<mousey-2 THEN  \(* leeway
 01AC           word=CHR$($0C)
 01B5           mousey=du
 01BD         ENDIF
 01BF       ENDIF
 01C1       IF dsa(8)+dsa(9)<>0 THEN  \(* a button was pressed
```

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```
 01EC        word=CHR$($0D)
 01F5      ENDIF
 01F7      END
 01F9

PROCEDURE joykey
 0000      PARAM word:STRING[1]; hand:INTEGER
 0012      TYPE registers=cc,a,b,dp:BYTE; x,y,u:INTEGER
 0037      DIM reg:registers
 0040
 0041      reg.a=0
 004C      reg.b=$13
 0058      reg.x=LXOR(hand,1) \(* invert the hand descriptor for joystick
 0091      RUN syscall($8D,reg) \(* Joystk
 00A8
 00A9      IF reg.a<>0 THEN  \(* fire button down
 00CB        word=CHR$(13)
 00D3      ENDIF
 00D5      IF reg.y<20 THEN  \(* leeway
 00ED        word=CHR$($0A)
 00F6      ELSE
 00FA        IF reg.y>44 THEN  \(* leeway
 0112          word=CHR$($0C)
 011B        ENDIF
 011D      ENDIF
 011F      END
 0121

PROCEDURE out
 0000      (* a handy routine when testing overlay windows
 002F      (* especially when the window is small, and
 005A      (* echo is turned off!
 0070      (* just type in "run out", then use
 0093      (* CTRL-A to repeat
 00A6
 00A7      ON ERROR GOTO 10
 00AD      LOOP
 00AF        RUN gfx2("OWEND")
 00BC      ENDLOOP
 00C0 10
 00C4      SHELL "tmode echo"
 00D2      END
 00D4
```

Listing 2: `bldmenu`

```
PROCEDURE bldmenu
 0000      (* builds a data file for "Menu" to use.
 0028      (* Note that this is not bullet- proof.
 004F      (* It is very easy to crash Menu by
 0073      (* supplying incorrect data at this point.
 009D
 009E      DIM array(12):STRING
 00AA      DIM fpath:STRING
 00B1      DIM reply:STRING[1]
 00BD      DIM select:STRING[80]
 00C9      DIM path,n:INTEGER
 00D4
 00D5      INPUT "Enter menu descriptor's file path > ",fpath
 0101      INPUT "Enter the menu's title > ",array(1)
 0125      INPUT "Enter the upper left x- coordinate > ",array(2)
 0155      INPUT "Enter the upper left y- coordinate > ",array(3)
 0185      INPUT "Enter the window length in characters (+2) > ",array(4)
 01BD      INPUT "Enter the hight in lines (+2)  > ",array(5)
 01E9      INPUT "Enter background color code (see p.9-35) > ",array(6)
 021F      INPUT "Enter character color code (see p.9-35) > ",array(7)
 0254      PRINT "Do you want a shadow? (Y/N) ";
 0275      GET #0,reply
 027E      PRINT
 0280      IF reply="Y" OR reply="y" THEN
 0295        array(9)="TRUE"
 02A3        INPUT "Enter the shadow color code (see p.9-35)> ",array(8)
 02D8      ELSE
 02DC        array(9)="FALSE"
 02EB        array(8)="0"
 02F6      ENDIF
 02F8      PRINT "Will you use the mouse? (Y/N) ";
 031B      GET #0,reply
 0324      PRINT
 0326      IF reply="Y" OR reply="y" THEN
 033B        array(10)="TRUE"
 0349        PRINT "Will you use the hi-res adapter? (Y/N) ";
 0375        GET #0,reply
 037E        PRINT
 0380        IF reply="Y" OR reply="y" THEN
 0395          array(11)="$0100"
 03A4        ELSE
 03A8          array(11)="0"
 03B3        ENDIF
 03B5      ELSE
```

```
03B9          array(10)="FALSE"
03C8          array(11)="0"
03D3        ENDIF
03D5
03D6        PRINT "Will you use the right- hand or left- hand port? (R/L) ";
0412        GET #0,reply
041B        PRINT
041D        IF reply="R" OR reply="r" THEN
0432          array(12)="1"
043D        ELSE
0441          array(12)="0"
044C        ENDIF
044E
044F        PRINT "Creating "; fpath
0460        CREATE #path,fpath:WRITE
046C        FOR n=1 TO 12
047C          PRINT #path,array(n); ",";
048E        NEXT n
0499        PRINT #path,array(11)
04A5        FOR n=1 TO VAL(array(4))-2
04BE          REPEAT
04C0            PRINT
04C2            PRINT "Enter menu selection "; n;
04E0            INPUT " > ",select
04EB          UNTIL LEN(select)<VAL(array(4))-3
0500          PRINT #path,select
050A        NEXT n
0515        CLOSE #path
051B
051C        PRINT
051E        PRINT CHR$(34); fpath; CHR$(34); " is now installed. To use it with
MENU, type in:"
055E        PRINT " 'RUN menu("; CHR$(34); fpath; CHR$(34); ",word,selection)'"
058D        END
```

Listing 3: `test`

```
Colors,1,1,10,6,6,0,0,TRUE,TRUE,$0100,1,$0100
Red
Green
Yellow
White
```

From the OS-9 prompt you can then type:

```
merge menutmp syscall inkey gfx
gfx2 > menu
```

and

```
del menutmp
```

Then use `attr` to set the execute attributes. This allows you to run them in one 8K block and kill them later. If you don't use `syscall`, `inkey`, `gfx` or `gfx2` elsewhere in your program, you can also kill them.

`out` is a routine not used by any part of *Carte Blanche*. I included it because it's a handy tool to have when you're working with a 10-by-5 character window and an error occurs. For example, there you are in Debug, and all the long lines are squeezed into this tiny space, and there's no border to show where the under window ends and the overlay begins. To make matters worse, the echo is turned off so you can't see what you're typing. Press Q and then ENTER to return you to the B prompt. Next type `run out`, press ENTER, and watch the overlay windows disappear and echo return to you. If your typing is not all that accurate, press CTRL-D before pressing ENTER to see if what you've typed is correct.

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What's in Store?

With little variation, THE RAINBOW follows a prescribed set of themes for each month, which we've done for the past several years. In January we feature the Beginner's issue; in November it's Telecommunications. So you pretty much know what topic is going to be covered in each issue.

As the CoCo Community changes, we have adjusted those themes accordingly. For instance, more readers expressed an interest in the electronic side of the CoCo, so we decided to incorporate an issue on hardware this month.

To assist you in submitting articles and programs, the themes for the remainder of the 1990 calendar year are as follows. (The dates shown in parentheses are the deadline dates for material to be submitted for that particular issue.)

April: Down to Business — programs designed to help you in setting up and operating a business with your Color Computer.
May: Hot off the Press — printer utilities and applications.
June: Summer Sizzlers — CoCo games and entertainment with a side order of utilities for general use. (3/1/90)
July: 9th Year Potpourri — our annual index and surprise (you never know *what* we'll cook up). (4/1/90)
August: Moving in With OS-9 — applications and utilities for OS-9, along with articles aimed at helping new users. (5/1/90)
September: Back to School — a compendium of educational software to get scholars on the right track for the '90-'91 school year. (6/1/90)
October: Graphically Speaking — discovering the graphics capabilities of the Color Computer. (7/1/90)
November: Dialing for CoCos! — a look at telecommunications, its importance to the CoCo Community, and what you need to get started. (8/1/90)
December: 'Tis the Season — Holiday utilities, graphics and music for the Color Computer. (9/1/90)

It is important to remember these themes are not all-encompassing — a given issue will also contain a mix of programs and articles not directly related to the theme. So don't hold back a good submission just because "it isn't time to send it in."

You may notice there are no plans for Games or Utilities issues for 1990. We do our best to provide two games and at least one utility in *every* issue. But we have received a lot of reader mail on the subject, so you might witness a change for the 1991 year. One idea is to combine the Home Help (February) and Business issues, thereby creating a slot for another theme. When the returns of the Reader Survey slow down a bit, we'll look at the results and organize RAINBOW themes accordingly for 1991.

* * * * *

To date, we have only one response regarding a subtle error on our January 1990 cover. The artwork depicts a low-end Tandy 1000 computer instead of a CoCo. The artist we contracted to do the cover also creates artwork for PCM (RAINBOW's sister magazine). Not being a computer user, he erroneously used a photo of the Tandy 1000 EX, thinking it was a photo of a CoCo (believe it or not, to some people the difference between the two is not all that distinct). We caught the mistake only after the magazine had been printed. We apologize.

Still, many RAINBOW readers may be unaware that Falsoft also publishes PCM. This situation has reminded us that we need to keep spreading the word. PCM is designed for owners of Tandy MS-DOS machines, though much of its contents apply to other MS-DOS machines as well; and many CoCo users have added MS-DOS to their repertoire. For more information, see the ad for PCM on Page 73 of this issue of THE RAINBOW.

— Cray Augsburg

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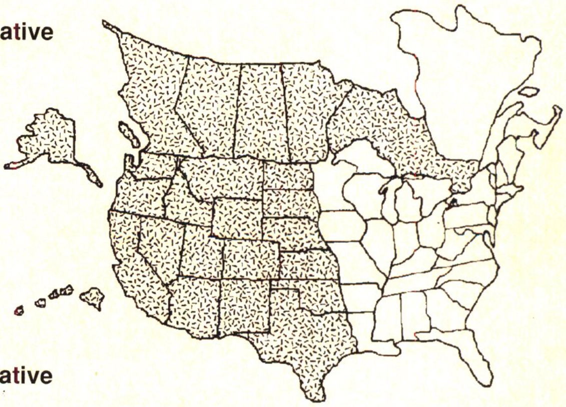

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UltiMusE III

The Ultimate Music Editor for the CoCo 3

"What if...
all CoCo music programs were this good?"

UltiMusE III is a MIDI 'Notation Sequencer'. It lets you write and edit sheet music on a 640x192 graphics screen using the mouse, play it on ANY MIDI-equipped synthesizer(s), and print out the score... Written by an experienced computer professional who is also a serious amateur musician and composer. With **UltiMusE III**, there is no more 'faking' to play what you want to hear! Perfect for the trained musician, **UltiMusE III**'s natural notation also helps a beginner to copy a favorite piece of sheet music just as it looks. Why should your music sound like a machine? **UltiMusE III** has a wide pitch range, from 4 octaves below Middle C to over 3 above. Each staff has a 4-octave range centered on one of four clefs - Treble, Guitar, Bass, and Double Bass. Staff placement, clefs, and part and MIDI channel assignments can ALL be edited... Professional software should use a professional Operating System. **UltiMusE III** uses the advanced features of OS-9 Level II and does not interfere with its windowing and [illegible]king in any way.

SYSTEM REQUIREMENTS: CoCo 3 with at least 256K memory, OS-9 Level 2, Mouse or Joystick (Hi-Res Joystick Adapter recommended), Synthesizer(s) with MIDI-In jack, plus a Serial to MIDI cable. Tandy's DMP printer, a MIDI Interface Pak, and a Multi-Pak are optional equipment.

NOW FEATURING
A 32K VIRTUAL MEMORY MUSIC SCORE BUFFER

UltiMusE III
$54.95

CASIO MT-240 MIDI KEYBOARD	$149.95
A/C POWER ADAPTER	$14.95
SERIAL TO MIDI CABLE	$19.95

Newspaper Plus
FINAL EDITION

DeskTop Publishing for the CoCo 3 just got better! With the **ALL NEW** NEWSPAPER PLUS - FINAL EDITION, you can create complete and sophisticated Banners, Headlines along with Text Columns and Graphics. Bring in different pictures, fonts, fill patterns, and text from disk and create a publication with that pro-look to it. Comes complete with 22 fonts, 50 NewsArt pictures and fill patterns. 128k or 512k Disk

STILL ONLY $48.95

'FINAL EDITION' is just a news print slogan meaning the very latest published issue. In the case of Newspaper Plus - Final Edition, it means the latest upgrade is NOW available. Here are some of the added features being offered;

- *Text import with Left, Right, Centered & Justification
- *RamDisk Utility (512k)
- *Stretch, Shrink & Compress picture utility
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DMP-PIC UTILITY: $19.95
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A complete Graphics Printing Utility program for the Star NX-1000 or Tandy's DMP or the Gemini Dot Matrix printers. Works in an easy to use Point 'N Click pull down menu environment. A MUST HAVE printing utility. CoCo 1,2,&3 Disk

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Check09MV interacts with MultiVue for FAST & EASY checkbook balancing. No more waiting for your bank statement for an ending balance. Check09MV will produce a check-by-check running total of your account in an easy to use format. End those monthly surprizes! 512k

MASTER CATALOG: $19.95
MASTER CATALOG 3: $19.95
Organize your floppy disks with Master Catalog. Supports single & double sided drives, alphabetize, sort, and search & find up to 3,000 filenames. Program supports a Column Format Hard Copy and is 100% ML for lightning response. When ordering, please specify CoCo 1,2, or 3 version.

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An Enjoyable, Hands-On Guide To OS-9 Level 2 On The Color Computer 3. Work from a step-by-step easy to follow tutorial book and program disk. Requires 2 drives, 512K and an 80-column monitor. START OS-9...NOW NO MORE EXCUSES.

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OS-9 Solution	$24.95
Schematic Drafting Processor	$24.95
Tape to Disk/Disk to Tape	$19.95
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26 disks filled with useable clip art for Newspaper Plus & Newspaper Plus - Final Edition. $100.00 for the complete set.

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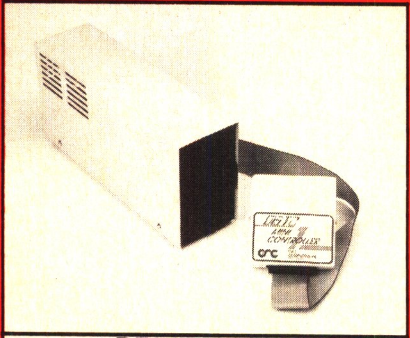
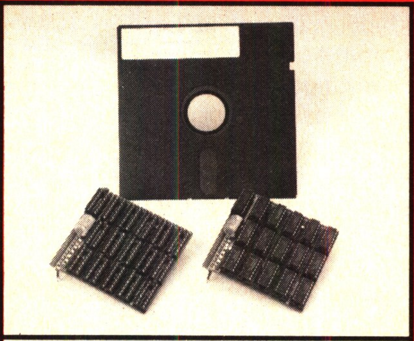
RS232	RS-232 Port	$ 49.95
DC-3C	Clock and Parallel Port	$ 40.00



DRIVE 0 PLUS

- Double sided 360K MPI 52
- Disto DC-7 controller and cable **$178.45**
- **Double Drive 0 $310** (5 ship)



MEMORY

• 512K Bare Board	**$40**
• Populated 512K & Software	**$89**
• 64K 8 Chip for CoCo 2	**$30**

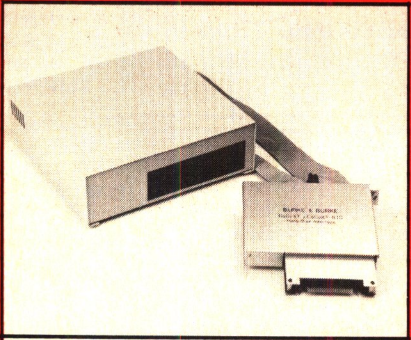
HOWARD BOX

VA-1	Video Converter	$ 29.45
RAL-1	Multipak Upgrade for 26-3024	$ 14.95
RAL-2	Multipak Upgrade for 26-3124	$ 14.95
RS-1	1.1 ROM Chip for Controller	$ 25.00
55BV	TEAC Floppy for 501 or 502	$ 98.00
52	MPI 360K Bare Floppy	$ 78.00
HR-2	Dual Hi-res Adapter	$ 39.45
1200HC	1200 Baud Modem	$119.00

SLOT-PACK II
MP - II

Too new for a picture, this freshly designed interface is the same size as the DISTO DC-3 Disk Controller. It fits directly into the CoCo expansion port and features three slots that allow packs like the DC-3, the Burke & Burke Hard Drive interface or the RS-232 pack. The MP-II draws it's power from the CoCo however, the B & B requires an optional AC power adapter. Designed by Chris Hawks.

MP - II	**$89.45**
AC Adapter AC - 9	**$14.95**



HARD DRIVE

20,000,000 Bytes or the equivalent to 125 R.S. 501's on line are packed into this hard drive, pre installed and ready to run. This complete easy to use package includes a Seagate 20 Meg Hard Drive, a DTC 5150 Controller and interface,* heavy duty case, power supply and fan and a 1 year warranty. This 20 meg Hard Drive will also work with Tandy and IBM clones. Basic driver, $29.95, lets you access this hard drive without need for OS-9.

See Rainbow Reviews 8/89

(9 ship)

HD-1 10 Meg**	**$349**
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*Burke & Burke **reconditioned

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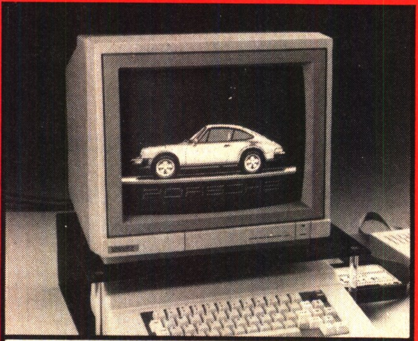

MAGNAVOX 8CM515 COLOR

- 80 Column
- Use with Coco, Tandy 1000's, IBM PC

CC-3 RGB cable 19.95

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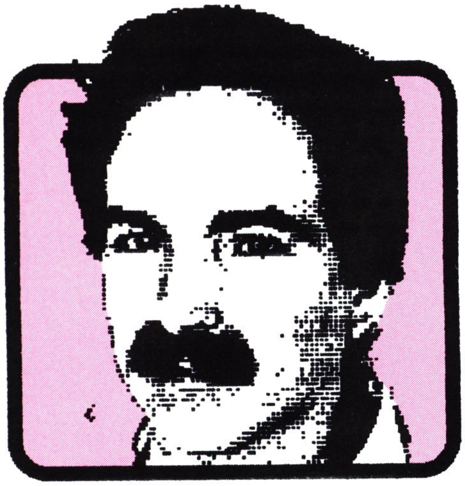
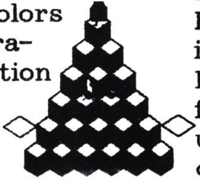


Pyramix

This is a fascinating CoCo 3 game of skill and coordination. Pyramix is 100% machine language written exclusively to take advantage of all the power in your 128K CoCo 3. The Colors are brilliant, the graphics sharp, the action fast. Written by Jordon Tsvetkoff and a product of ColorVenture. **Disk: $19.95**



The Freedom Series

Vocal Freedom

Vocal Freedom turns your computer into a digital voice recorder. The optional Hacker's Pac lets you incorporate voices or sounds that you record into your own BASIC or ML programs. This is not a synthesizer. Sounds are digitized directly into computer memory so that voices or sound effects sound very natural. One "off-the-shelf" application for Vocal Freedom is an automatic message minder. Record a message for your family into memory. Set Vocal Freedom on automatic. When Vocal Freedom "hears" any noise in the room, it plays the prerecorded message directly from its Random Access Memory with amazing fidelity! You may also SAVE or LOAD sounds to and from DISK. VF also tests memory to take advantage of from 64K up to a full 512K. Requires low cost amplifier (RS cat. #277-1008) and any microphone. Will run on a CoCo 1, 2, or 3. Vocal Freedom **Disk: $34.95.** Optional Hacker's **Pac Disk: $19.95. Disk for both: $49.95**

Mental Freedom

Would your friends be impressed if your computer could read their minds? Mental Freedom uses the techniques of Biofeedback to control video game action on the screen. Telekinesis? You control the action with your thoughts and emotions. Your goal is to materialize and levitate objects with the power of your mind while avoiding the insidious cobra. Mental Freedom teaches peace of mind in the face of adversity. Mental Freedom even talks in a perfectly natural voice without using a speech synthesizer! Requires Radio Shack's low cost Biofeedback monitor, Cat. #63-675. Will run on a CoCo 2 or 3 but not CoCo 1. **Disk: $24.95**

Lightning Series

These three utilities give real power to your CoCo 3.

Ramdisk Lightning

This is the best Ramdisk available. It lets you have up to 4 mechanical disk drives and 2 Ram drives on-line and is fully compatible with our Printer Lightning. **Disk: $19.95**

Printer Lightning

Load it and forget it--except for the versatility it gives you. Never wait for your printer again! Printer runs at high speed while you continue to work at the keyboard! **Disk: $19.95**

Backup Lightning

Reads your master disk once and then makes super fast multiple disk backups on all your drives! No need to format blank disks first! Supports 35, 40 or 80 track drives. This utility requires 512K. **Disk: $19.95**

COCO Braille

Produce standard grade 2 Braille on a Brother daisy wheel printer. Easy to use for sighted or blind user. No knowledge of Braille is necessary. Call for free sample. Will run on CoCo 1, 2, or 3. **Disk: $69.95**

VDOS the UnDisk

VDOS, The Undisk, ramdisk for the CoCo 1 or 2 only. Available only on **tape: $24.95**

VDUMP, backup Undisk files to single tape file. Requires VDOS. **Tape: $14.95**

VPRINT, Print Undisk directory. Requires VDOS. **Tape: $9.95**

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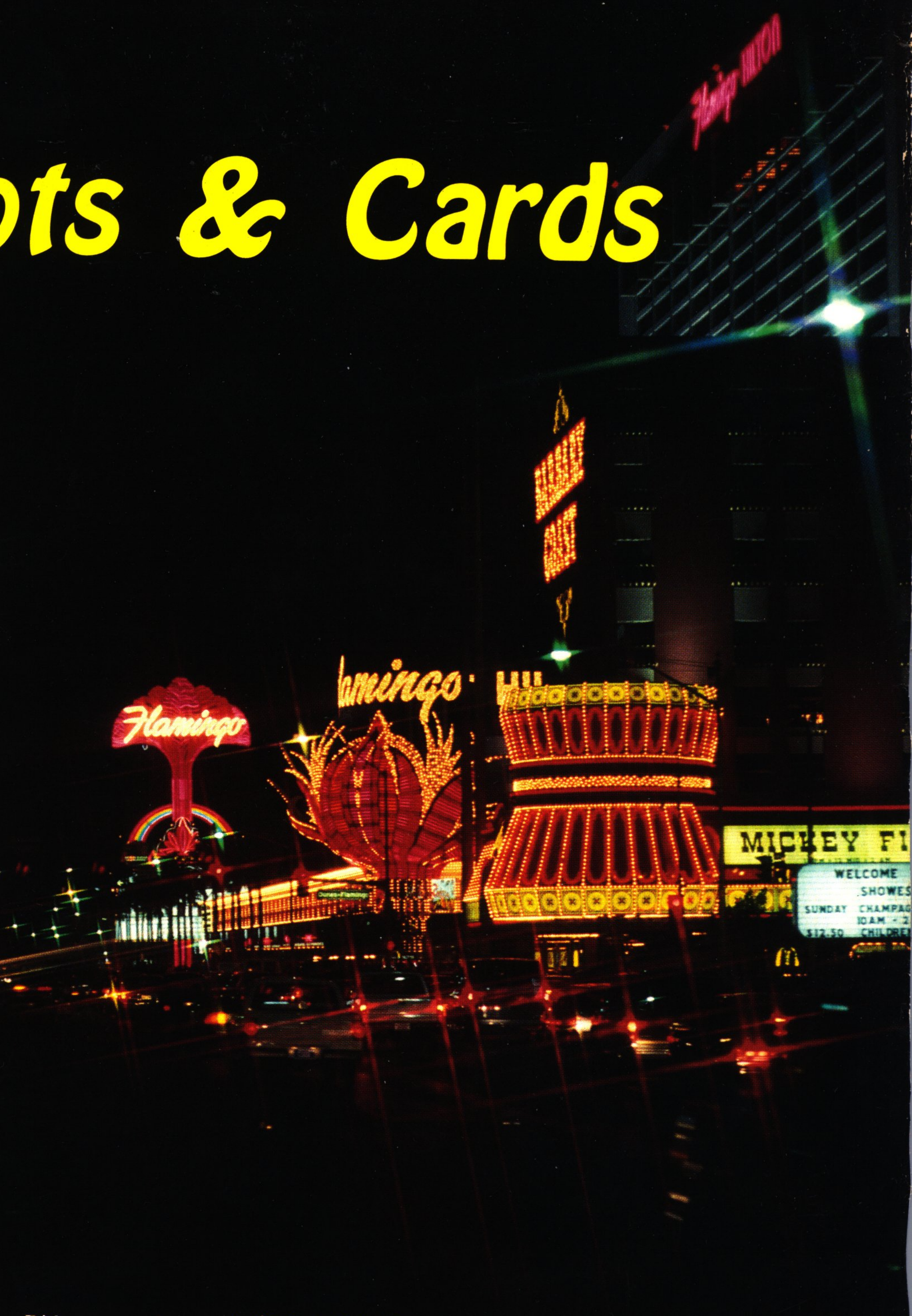
Slots & Cards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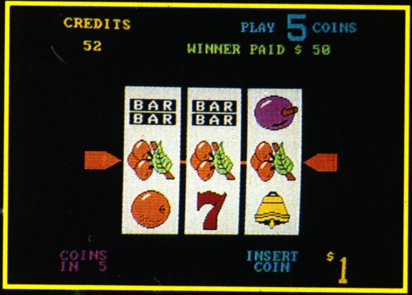
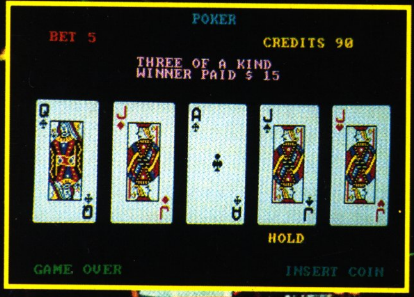
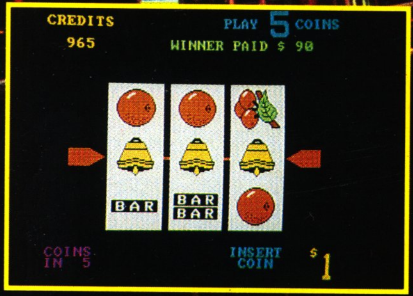
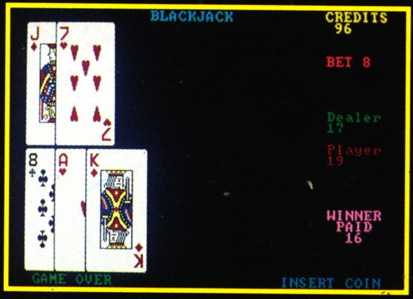

CREDITS
52
PLAY 5 COINS
WINNER PAID $ 50
BAR BAR
BAR BAR
7
COINS IN 5
INSERT COIN
$1


POKER
BET 5
CREDITS 90
THREE OF A KIND
WINNER PAID $ 15
HOLD
GAME OVER
INSERT COIN


CREDITS
965
PLAY 5 COINS
WINNER PAID $ 90
BAR
BAR BAR
COINS IN 5
INSERT COIN
$1


BLACKJACK
CREDITS 96
BET 8
Dealer 17
Player 19
WINNER PAID 16
GAME OVER
INSERT COIN

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